SEPTEMBER 1995

CALTRAIN SAN FRANCISCO
DOWNTOWN EXTENSION PROJECT
CONCEPTUAL DESIGN AND DRAFT EIS/EIR

Utilities Inventory and Relocation/ Reinforcement Report

PENINSULA CORRIDOR JOINT POWERS BOARD

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ICF KAISER ENGINEERS/DELEUW CATHER TEAM
association with
JAMES & MOORE, AGS, AND MIG


EXISTING CALTRAIN S.F. TERMINAL
CALTRAIN TERMINAL ALTERNATIVES
MISSION BAY
CHINA BASIN
CHINA BASIN ST.
MISSION ROCK
THE EMBARCADERO
BAY BRIDGE
FERRY BLDG.
MOSCONE CONVENTION CENTER
CIVIC CENTER STATION
POWELL ST STATION
MONTGOMERY ST STATION
EMBARCADERO STATION
BART/MUNI
BART
N
ALABAMA ST.
FLORIDA ST.
BRYANT ST
UTAH ST.
BRUNO AVE
VERMONT ST.
DE HARO ST.
11TH ST.
10TH ST.
9TH ST.
8TH ST.
7TH ST.
6TH ST.
5TH ST.
4TH ST.
3RD ST.
2ND ST.
1ST ST.
15TH ST.
16TH ST.
ALAMEDA ST.
DIVISION ST.
HOOPER ST.
IRWIN ST.
HUBBELL ST.
DAGGETT
OWENS ST.
CHANNEL
ILLINOIS ST.
KING
TOWNSEND
BRANNAN
BRYANT
RITCH ST.
ZOE ST.
SOUTH PARK
STANFORD
BERRY
COLIN P. KELLY ST.
DELANCEY ST.
HAWTHORNE
ESSEX ST.
NEW MONTGOMERY
MISSION
FREMONT
BEALE ST.
MAIN
SPEAR
FOLSOM
HARRISON
HOWARD
STEUART
DAVIS
FRONT
BATTERY
SANSOME
MONTGOMERY
KEARNEY
GRANT
STOCKTON
POWELL
MASON
TAYLOR
JONES
LEAVENWORTH
MCALLISTER
GOLDEN GATE
TURK
EDDY
ELLIS
O'FARRELL
GEARY
POST
SUTTER
BUSH
PINE
CALIFORNIA
SACRAMENTO
CLAY
WASHINGTON
JACKSON
PACIFIC
COLUMBUS
DRUMM
101
280
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CALTRAIN S.F. DOWNTOWN EXTENSION PROJECT DEIS/DEIR

UTILITIES INVENTORY AND RELOCATION/REINFORCEMENT REPORT

PREPARED FOR THE

A CORRIDOR JOINT POWERS BOARD

PREPARED BY

AGS, INC.

UNDER SUBCONTRACT TO
ICF KAISER ENGINEERS, INC.

November 7, 1995

CalTrain S.F. downtown
extension project
1995.

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UTILITIES INVENTORY AND RELOCATION/REINFORCEMENT REPORT
for the
CALTRAIN S.F. DOWNTOWN EXTENSION PROJECT DEIS/DEIR

1. Introduction

This report, prepared as part of the Draft Environmental Impact Statement/Draft Environmental Impact Report for the CalTrain Downtown Extension project, describes and inventories the existing utility systems in the project area and discusses how the proposed project affects the utilities and how utility issues affected alignment alternatives.

The report is organized by the twelve segments established for the Design Options Screening capital cost estimates. Each segment description includes a discussion of the segment alternatives (if any), the utility impacts in that segment, and the proposed methods of modifying the existing systems.

The existing utility systems are depicted on eight drawings at 1" = 100' scale on aerial photo bases, titled "Utilities", which cover the proposed project area. These are included in the CalTrain Project Drawings. Discussions and recommendations in this report are based on alignment plans and profiles shown in the CalTrain Project Drawings dated 9/30/95.

2. Overview of Proposed Project

The Joint Powers Board, operators of the CalTrain commuter rail service from San Jose/Gilroy to San Francisco wish to improve service by extending the San Francisco terminus from its present location at Fourth and Townsend streets to a new downtown location. Two downtown terminal locations are being studied. The first is an underground station located in Beale Street, connecting to the Embarcadero Muni/BART Station. The second is either an underground or aerial station at the site of the Transbay Transit Terminal on Mission Street between First and Fremont streets.

3. Summary of Proposed Alignment Alternatives

Alternative station configurations and alternative routes for reaching the stations are currently being evaluated. They are summarized in the following paragraphs. The corresponding segments which compose each alternative are included in parenthesis. See Figure 1 for segment locations.

3.1 The Beale Street terminal alternatives include:

Alt. 2A-CT, a three-level/four-track terminal that extends from Howard Street to Market Street. It is reached by cut-and-cover subway alignment along Townsend, Embarcadero and Beale streets. (Segments 1A, 4, 5, 3AC)

Alt. 2A-MT, terminal configuration is the same as 2A-CT, but Townsend and Beale streets are connected by a mined tunnel on an arc from 3rd/Townsend to Harrison/Beale. (Segments 1A, 2, 3AM)

Alt. 2B-CT, a two-level/four-track staggered terminal with two tracks terminating at Market Street and two tracks terminating at Mission Street. It is reached by cut-and-cover subway alignment along Townsend, Embarcadero and Beale streets. (Segments 1A, 4, 5, 3BC)

Alt. 2B-MT, terminal configuration is the same as 2B-CT, but Townsend and Beale streets are connected by a mined tunnel on an arc from 3rd/Townsend to Harrison/Beale. (Segments 1A, 2, 3BM)

Alt. 2C-CT, a two-level/four-track terminal that terminates at Mission Street and connects to Market via a pedestrian tunnel. It is reached by cut-and-cover subway alignment along Townsend, Embarcadero and Beale streets. (Segments 1A, 4, 5, 3CC)

Alt. 2C-MT, terminal configuration is the same as 2C-CT but Townsend and Beale streets are connected by a mined tunnel on an arc from 3rd/Townsend to Harrison/Beale. (Segments 1A, 2, 3CM)

3.2 Transbay Terminal alternatives include:

Alt. 3A-CT, the CalTrain terminal is located on the second level of a new Transbay Terminal. It is reached by cut-and-cover subway alignment along Townsend and Colin P. Kelly streets with a section of mined tunnel under Essex Street between Bryant and Folsom streets, then by aerial structure from Folsom Street to the terminal. (Segments 1A, 10, 8, 9A)

Alt. 3A-MT, same as 3A-CT but the alignment uses a longer mined tunnel running from 3rd/Townsend to Folsom/Essex in a sweeping arc. (Segments 1A, 11, 8, 9A)

Alt. 3B-CT, the CalTrain terminal is located below ground in a new Transbay Terminal. It is reached by cut-and-cover subway alignment along Townsend and Colin P. Kelly streets with a section of mined tunnel under Essex Street between Bryant and Folsom streets, then by cut-and-cover subway again from Folsom Street to the terminal. (Segments 1A, 10, 8, 9B)

Alt. 3B-MT, same as 3B-CT but the alignment uses a longer mined tunnel running from 3rd/Townsend to Folsom/Essex in a sweeping arc. (Segments 1A, 11, 8, 9B)

3.3 King Street Alignment option

Each of the above alternatives includes an option where the alignment follows King Street instead of Townsend Street. These are indicated on the drawings by a "K" in place of the "T". For the King Street options, Segment 1A would be replaced by Segment 6A, Segment 10 would be replaced by Segment 7, and Segment 4 would be replaced by Segment 12.

3.4 Portal at 7th/Berry option

Each of the above alternatives also includes an option where a longer cut-and-cover subway is used in Townsend or King streets. The portal would be located at 7th/Berry streets instead of 5th/Townsend or 6th/King streets. With this option, Segment 1A would be replaced by Segment 1B in the Townsend Street alignments and Segment 6A would be replaced by Segment 6B in the King Street alignments.

4. Overview of Existing Utility Systems

4.1 Sanitary Sewer and Storm Drain System

The San Francisco Department of Public Works (DPW) maintains a combined storm drain and sanitary sewer system. The combined system collects sanitary waste and storm runoff and routes them to one of the city's sewer treatment plants for processing and eventual discharge into the bay. Most of northeast San Francisco drains to the China Basin Channel (Mission Creek) in the project area. The Division Street outfall sewer, consisting of four 9'-6" by 8'-3" box culverts, carries flow from the Mission district and upper Market area to the channel. Large sewers in 4th, 5th, 6th and 7th streets carry flow from the downtown and south-of-Market areas to the channel. A 17.5' wide box sewer (Channel Outfalls Consolidation sewer) beneath the Embarcadero and King Street carries flow from the lower south-of-Market and waterfront areas to the channel.

All flow is collected at a pump station (Channel Pump Station) at the upper end of the channel near 7th and Berry streets where it is pumped via a 66" force main to a sewage treatment plant (Southeast Water Pollution Control Plant) south of the project area. During the dry season, sewers carry sewage only and have a low flow volume. During the rainy season, sewers carry storm runoff as well and approach maximum capacities during severe storms. The 17.5' box sewer serves a dual purpose. It intercepts all sewers along the waterfront and China Basin Channel and routes their flows to the pump station, and, during heavy storms when the flows

collecting at the pump station exceed it's capacity, it serves as a temporary storage facility, containing the excess flow until the storm subsides.

Much of the existing sewer system in the project area is quite old with many sewers constructed of brick. Older sewers impacted by CalTrain construction will most likely require replacement of at least the impacted portion with new vitrified clay pipe (VCP), reinforced concrete pipe (RCP), or reinforced concrete (RC) box sewers. Many storm drain inlets and their connecting laterals will also be displaced by proposed construction and require replacement.

4.2 Potable Water System

The potable water system in the project area, maintained by the San Francisco Water Department, is characterized by medium-sized ductile iron pipes, predominantly 8-12 inches in diameter with some reaches up to 20 inches in diameter. Pipes over 16 inches are generally steel. Water lines must generally be located at least 5 feet horizontally away from sewer lines and have 3 feet of ground cover. Service laterals in the downtown area serving multi-story structures are generally 6-8 inches in diameter, sized to accommodate larger loads and fire sprinkler systems. In areas of cut-and-cover construction, approximately half of the service laterals will need to be supported in place across the excavation.

4.3 Auxiliary Water Supply System

The San Francisco Fire Department owns and operates an auxiliary water supply system (AWSS), strictly for fire-fighting, which supplies water to fire hydrants (the system is maintained by the Department of Public Works). This system, developed after the 1906 earthquake, is parallel to the potable water supply system. The AWSS is normally charged with potable water from the city water supply system. In the event of an earthquake or other emergency where the Hetch Hetchy system or the local water supply pipes are damaged, the AWSS can be converted to saltwater supply for fire fighting. The San Francisco Fire Department maintains emergency saltwater pumping stations to charge the AWSS system during these emergencies. The conversion is accomplished by closing remote control valves, isolating the AWSS from the potable water system, and bringing one or more of the saltwater pumping stations on line.

One of the pumping stations is located in the project area at the northwest corner of 2nd and Townsend streets. It draws seawater from the bay via a 5-foot diameter reinforced concrete tunnel which runs along the north side of Townsend Street to an intake structure at the Embarcadero. The invert of the saltwater intake tunnel ranges between -21' and -22'. Flow to the pump station is maintained by the pressure head of the Bay water elevation. Minor realignment to raise or lower a portion of the tunnel can be done but the water supply to the pump station cannot be interrupted.

The AWSS system is also supplemented by water storage cisterns located strategically throughout San Francisco. The underground cisterns are located at street intersections and are delineated by a circular ring of bricks in the pavement. They are stand alone storage tanks and are not connected to any water supply pipes. They are filled manually from nearby fire hydrants. One of these cisterns is located in the project area at the intersection of Beale and Howard streets.

4.4 Natural Gas

The natural gas distribution system is owned and operated by Pacific Gas and Electric (PG&E). Many parts of the system in the downtown area are quite old and PG&E has begun a replacement program. The older lines are low pressure (approximately 0.25 psi) cast iron pipes ranging from 4-16 inches in diameter. The new replacement lines are generally high pressure plastic pipe ranging from 2-4 inches in diameter. The new facilities operate at a pressure of approximately 32 psi.

When construction of the downtown extension takes place, a coordinated effort between PG&E and CalTrain to replace existing low pressure cast iron lines with new high pressure plastic lines would be mutually beneficial. While PG&E would have the opportunity to upgrade its system, the smaller plastic pipes would be easier to relocate or support in place along the alignment.

4.5 Steam System

Some underground steam lines still exist in the south-of-Market area. They are owned and operated by Steam Systems (Thermal Ventures, Inc.) and provide steam heat to buildings. The steam line closest to the project area runs down 2nd Street, but it does not extend east of 2nd Street or south of Howard Street and is not impacted by the project.

4.6 Electrical System

Electrical service in San Francisco is also provided by PG&E. Most of the project alignment is characterized by underground electrical service. Areas further from downtown, such as along Townsend Street, have overhead electrical service in addition to some underground service.

Underground electrical vaults exist throughout the project area. They contain transformers or other electrical switch gear, primary power splices (over 1 kilovolt), and secondary power connections (generally 120 to 480 volt). The vaults are usually constructed of reinforced concrete (RC), and range in size from 3' X 5' to 24' X 34'. They are divided into three size categories for purposes of this report: small vaults are sizes up to 5' X 7', medium vaults are sizes up to 10' X 10', and large vaults are those over 10' X 10'. The vaults in the vehicular areas of the streets

are generally owned by PG&E, while the vaults beneath the sidewalks, adjacent to buildings, are generally built and owned by the building owners to PG&E specifications. A vault adjacent to a building contains the power connections for that building. If one of these vaults has to be relocated, the electrical switchroom inside the building would generally have to be relocated as well. The density of vaults and connecting conduit increases significantly with proximity to Market Street.

The underground conduit is generally constructed of plastic pipe, but older conduit of other materials exists. The conduit runs are usually consolidated into duct banks and encased in concrete. In the segment by segment breakdown of quantities, only the lengths of conduit currently carrying cables and wires are included in the total footage. Thus the electrical quantities refer to total length of "active conduit". Significant additional lengths of empty spare conduits also exist in the project area with the active conduit but are not counted or included in the totals.

PG&E's Embarcadero Substation is located in the project area at the corner of Folsom and Fremont streets. High voltage 230 kV underground trunk lines terminating at this substation cross the Alternative 3 alignments at Harrison and Folsom streets. These lines are highly sensitive and will require special treatment and care where exposed by excavation.

The City of San Francisco also maintains street lights and traffic signals throughout the project corridor, many of which will be displaced by construction and require replacement and/or relocation.

4.7 Communication Facilities

Communication facilities are primarily operated by Pacific Bell. These facilities are similar to the electrical with some overhead service and a significant amount of underground service. The splice boxes have been grouped into the same small, medium, and large size categories as the electrical vaults. The underground cable mains are either in individual conduits or multiple-conduit rectangular duct banks. The individual conduits and duct bank installations are also similar to the electrical service. The duct banks consist of several ducts for individual cables combined into a rectangular unit. Because of the many joints in the duct bank units, they may be more difficult to support in place than individual conduits.

In tallying the lengths of PacBell conduit, it was difficult to determine at the time of this report which conduit carried active wires and which were spares, so the communications quantities refer to total length of "conduit", which includes empty spares. Therefore, a percentage of the total conduit indicated is not currently in use.

Long distance communication facilities provided by AT&T, MCI and Sprint are also located in the project area, however exact locations of these services could not be determined at the time of this report.

Cable television is also believed to exist in the project area, but the precise nature of the facilities could also not be determined at the time of this report.

5. Evaluation of Proposed Project Construction Methods and Impacts on Existing Utility Systems

The proposed construction methods for the CalTrain Downtown Extension can be generally classified as follows: construction on grade; transition from at-grade to subway; cut-and-cover subway; mined tunnel; and aerial (elevated structure).

5.1 Construction on grade

Construction on grade is generally confined to Seventh Street and small portions of Townsend and King streets. The new yard locations will also be built primarily on grade. Existing utilities that run longitudinally under the railroad alignment must be relocated from below the tracks to eliminate interference with railroad operation due to maintenance functions requiring excavation. Utilities that cross at shallow angles to the railroad alignment should be realigned to cross more nearly perpendicular. Larger structures such as drainage pipes or culverts need to be analyzed for their structural ability to withstand the loading from the trains and reinforced or replaced if necessary. Smaller utilities such as water, electrical, or communication facilities crossing the alignment are generally placed in sleeves or conduits where they cross the tracks in order to facilitate removal and replacement of damaged sections without requiring excavation across the track alignment.

5.2 Transition from at-grade to subway

Transitions from surface to subway generally present an effective wall to most utility systems. Utilities are not placed under the U-wall section because of the difficulty of access, maintenance and repair. Where U-wall sections intersect utilities, the utilities will generally be rerouted around either end of the transition zone.

5.3 Cut-and-cover subway

Cut-and-cover subway construction is very disruptive to utility systems. The width of the proposed project requires the excavation of a large part of the street right-of-way in most cases (street right-of-ways are typically 82.5 feet in the project area). The open cut requires relocation of many utilities. The relocation may consist of relocating laterally to a position in the street not to be excavated, relocating to another street alignment, or temporarily supporting in place during construction and then replacing in the street between the pavement and the roof of the subway box after construction is completed.

The combined sewers in San Francisco are generally too large to be supported in place longitudinally along the excavation and would need to be relocated adjacent to the construction area. Sewer laterals would need to be adjusted to work with the new main locations and those that cross the alignment would need to be carefully supported in place to maintain the gravity flow.

Where water mains are supported in place over the open excavation, special support will have to be provided horizontally at bends in the pipe to offset the thrust force of the flowing water normally restrained by the surrounding soil.

5.4 Mined tunnel

Most of the mined tunnel alignments do not follow the overhead street alignments so there is minimal interference with the primary utility routes except at street crossings. At crossings the mined tunnel construction is generally below the level of existing utilities and would not directly impact them. However, there is a potential danger of subsidence occurring in the soil above the tunnel construction which could have a detrimental impact on utilities overhead. If the soil subsided enough to create a soft spot in the foundation support of a utility line, the pipe could sag and break.

5.5 Aerial (elevated structure)

The elevated structure approach to the Transbay Terminal would primarily impact underground utilities at the locations of structure footings. However, until preliminary engineering of the structure is completed, the exact locations of these footings and consequent utility impacts is not known.

6. Description of Utility Impacts by Segment

The segment breakdowns described in the following pages are as used in the Design Options Screening capital cost estimates. They are shown on Figure 1. For purposes of this report the following convention for cardinal directions is followed. Market Street and parallel streets are defined as east/west with east being the bay side terminus. First Street and parallel streets are defined as north/south with Market Street being north of Townsend Street.

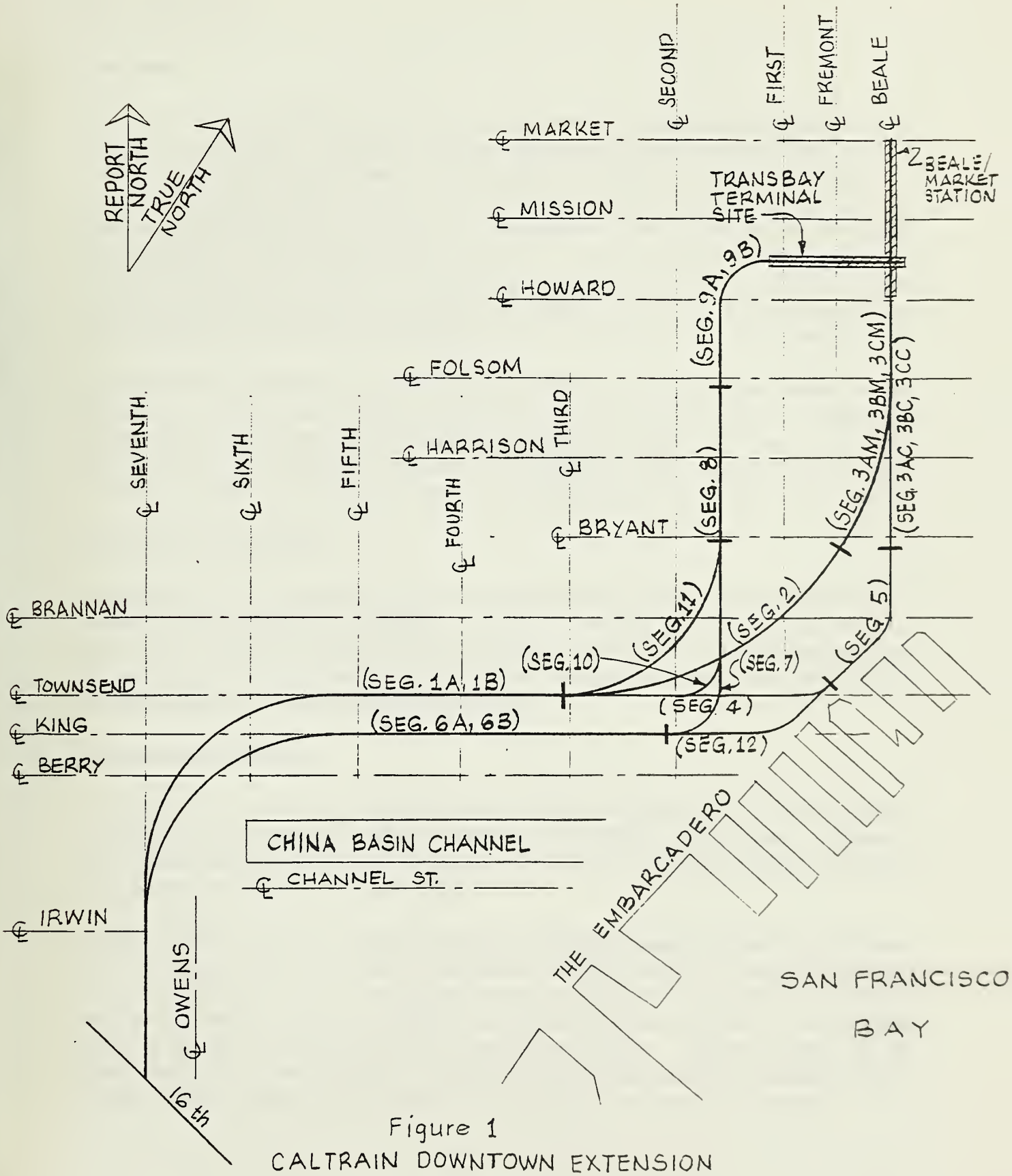

Figure 1
CALTRAIN DOWNTOWN EXTENSION
LOCATION MAP

6.1 Segment 1

Location:

Segment 1 has two options, 1A and 1B. Segment 1A begins at the intersection of 16th and 7th streets. It extends north along the surface on the east side of 7th in the existing CalTrain right-of-way. At King Street it begins a 90° turn to the right and enters Townsend Street between 7th and 6th. After crossing 6th at-grade the alignment descends along Townsend in a U-wall section cutting across 5th Street and entering a portal between 5th and 4th. From the portal, Segment 1A will continue underground beneath Townsend, ending just before 3rd Street. Along Townsend Street the alignment straddles the south right-of-way line, with about half the width in the Townsend Street right-of-way and half in the adjacent property.

Segment 1B is similar to 1A except that it descends underground earlier in the alignment. The U-wall transition section begins at Hooper Street, the alignment descends along 7th Street, and the portal is located at 7th/Berry streets. The other difference is that Segment 1B does not encroach into private property along Townsend Street. It is located further north, staying within the current right-of-way.

Proposed Construction:

Construction of the at-grade portion from 16th Street to 6th/Townsend streets will primarily involve laying a compacted foundation bedding and then laying the new track work. The U-wall section from 6th Street to the portal will be excavated and the permanent U-wall structure built in place. The tunnel section from the portal to 3rd Street will be constructed by cut-and-cover.

Existing Utility Impact:

If Segment 1A is used, it is assumed that no utility relocation will be required along 7th Street since the route runs at-grade in the CalTrain right-of-way. However, some reinforcement of existing utilities crossing under the CalTrain right-of-way may be required where new track is installed.

Utilities located in the south side of Townsend Street between 7th and 3rd will have to be relocated to the north side of the street. Utilities crossing Townsend Street at 6th will have to be sleeved to facilitate maintenance and to support the additional load of the surface crossing. Utilities crossing at 5th Street will have to be rerouted because the U-wall section creates a permanent barrier. Utilities crossing at 4th Street will have to be supported in place during cut-and-cover construction, then reburied during street restoration after construction of the tunnel is complete.

If Segment 1B is used, utilities crossing 7th Street between Hooper and King streets will have to be rerouted and utilities crossing Townsend Street at 6th and 5th will be treated the same as at the 4th Street crossing described above.

Sewer:

Segment 1 crosses the Division Street outfall sewer at 7th and Berry streets. This large structure consists of four RC box sewers, each 9'-6" X 8'-3", emptying into the Channel Pump Station at the upper end of the China Basin Channel. The current Segment 1A profile crosses over this structure at-grade and no impact is assumed. If Segment 1B is used however, the profile will be descending along 7th Street at this point, bisecting the sewer, and the sewer would have to be relocated. During a previous study of Caltrain improvements, the DPW did a preliminary investigation of lowering the Division Street outfall sewer and concluded that the sewer could probably be lowered to pass under a subway section. The current invert of the sewer is approximately -11 feet. The bottom of the U-wall structure would be at approximately -20 feet at the sewer crossing. The invert of the pump station floor is approximately -35 feet. The sewer would have to be lowered to pass through the 15 feet remaining between the bottom of the retained cut U-wall section and the pump station floor. Hydraulic modeling studies would have to be performed to verify that a change in the grade line would not cause flooding upstream. Relocation of the Division Street outfall sewer would be a major alteration to the existing system and would require a significant coordination effort with the Department of Public Works.

A 12"/15" VCP collector sewer runs in the center of Townsend Street between 7th and 4th, and a 3' X 5' brick sewer runs from 4th to 3rd. These sewer lines can remain in place as the U-wall section and cut-and-cover sections occupy only the south third of Townsend Street at this location.

A 10" sludge force main runs along the south side of Townsend Street from 7th to 5th turning north up 5th. This line will have to be relocated between 7th and 6th where it falls beneath the surface track alignment and will have to be relocated between 6th and 5th because the U-wall section will occupy the south side of the street. It is assumed this line can be permanently relocated to the north side of Townsend Street between 7th and 5th. Another option would be to reroute it down an entirely different street allowing more room for utilities required in Townsend Street.

A 10' X 7' RC semi-circular sewer with an invert of -12', and a 6' diameter RC circular sewer with an invert of -11' cross Townsend Street at 6th. Both structures are on piles. Segment 1A crosses 6th Street at-grade, so it is assumed these sewer structures can remain in place. However, a large sewer crossing in 5th Street will be blocked by the alignment and would probably be rerouted to 6th. There is not room for a third large sewer structure in 6th Street due to the I-280 column footings so the 6' circular sewer would have to be replaced with a larger sewer combining the

6th and 5th street flows. Segment 1B would pass under 6th Street as a subway section. The current profile almost clears below the two sewers. It is assumed the profile could be adjusted to allow these sewers to remain in place. They would require substantial supporting structures to hold them during cut-and-cover construction.

A 9' X 7' RC semi-circular sewer on piles with an invert of -11' crosses Townsend Street at 5th. Since the Segment 1A alignment descends below ground across 5th, the U-wall structure completely blocks this sewer. The sewer would have to be rerouted to a point where it could pass over or under the alignment. One option would be to run down Townsend Street to 4th then run a second large sewer down 4th Street to the 17.5' box consolidation sewer in King Street. However two potential problems exist. One, the current profile does not appear quite low enough at 4th Street to allow this relocated sewer to pass over, and two, the King Street Surface Roadway and Muni Metro Extension Project is approaching the construction phase which will extend the Muni light rail lines from 3rd to 5th. With this project completed before construction of a Caltrain alignment it would be more difficult to build a new sewer beneath it. If either of these problems proves insurmountable, another option would be to reroute the 5th Street sewer down Townsend or Bluxom streets to 6th and consolidate it with the 6' circular sewer in a new sewer constructed down 6th. With Segment 1B, the 5th Street sewer could remain but would have to be supported in place over the excavation during cut-and-cover construction. As in 6th Street, this would require a substantial supporting structure.

Two new sewers are currently planned for 5th Street as part of the Muni extension project. A 23' (wide) X 2' (high) RC box storm drain with an invert of approximately -6' will run down 5th Street from Townsend to Berry. An 18" ductile iron pipe (DIP) storm drain will begin in Townsend Street 400' west of 5th, then run down Townsend Street to 5th, turn south into 5th with an invert of -8.3' at the south right-of-way line of Townsend Street, and run down 5th to Berry Street. Both are intended to relieve storm flooding problems in Townsend between 4th and 6th streets. The entire length of 18" storm drain and the section of 23' X 2' storm drain crossing King Street will be constructed under the Muni extension contract. Segment 1A will block 5th Street requiring rerouting of the 18" storm drain. The completion plan for the 23' X 2' storm drain at 5th/Townsend is not known and should be coordinated with CalTrain design plans. With Segment 1B, the alignment will clear below both structures. The 18" pipe could be supported in place over the excavation but the construction of the 23' X 2' box should be coordinated so it is built after the CalTrain subway in that area is completed.

A 6.5' diameter brick-lined RC circular sewer on piles with an invert of -10' crosses Townsend Street at 4th. The alignments of both Segments 1A and 1B will pass beneath this sewer allowing it to be maintained in place. However, the Segment 1A profile may have to be adjusted downward slightly to provide clearance for a bridge

structure which would have to be built to support the sewer in place over the open excavation during cut-and-cover construction.

A 21" sewer with an unknown invert and a 30" sludge force main with an invert of -7' also cross Townsend Street at 4th. These pipes could remain in place and would have to be supported over the open excavation for either Segment 1A or 1B.

Approximately 3 sewer service laterals would cross the open excavation from the south side of Townsend between 5th and 3rd. These would have to be supported in place during construction.

Approximately 12 storm drain inlets in Segment 1A and 18 inlets in Segment 1B would have to be replaced during Townsend Street reconstruction over the cut-and-cover section (between 5th and 3rd in Segment 1A or between 7th and 3rd in Segment 1B) .

Potable Water:

An 8" water main runs intermittently along Townsend Street between 7th and 3rd. This main is located on the north side of the street and should not be affected by the U-wall or cut-and-cover construction for either Segment 1A or 1B. Approximately 3 service laterals branch off of this line between 5th and 3rd providing service to the south side of Townsend. These would have to be supported in place over the cut-and-cover excavation during construction.

An 8" water main runs down 5th Street crossing Townsend. The U-wall in Segment 1A will block this line. However, because of the interconnected grid pattern of the water system, it may be possible to discontinue the through-flow of this line and cap the line off at both sides of the U-wall. If not, this line would have to be rerouted around the end of the U-wall. For Segment 1B it could remain and be supported in place over the cut-and-cover excavation.

A 12" main crosses Townsend at 4th which would have to be supported in place during construction for either segment.

An 18" steel line crosses the alignment at Berry Street and 7th. For Segment 1A this line would remain in place without impact, but under Segment 1B the U-wall section would intersect this line and it would have to be rerouted around the back side of the portal.

Auxiliary (Fire) Water:

Three 12" auxiliary water lines cross Townsend Street in Segment 1, one at 6th, one at 5th, and one at 4th. For Segment 1A the crossing at 6th can remain in place but will require additional reinforcement. The crossing at 5th may be able to be capped

as described above for the potable water main, but if not will have to be rerouted around the end of the U-wall. The crossing at 4th will have to be supported in place during construction. For Segment 1B all three crossings can remain but will have to be supported in place during cut-and-cover construction.

A hydrant on 5th Street at the south side of Townsend will be displaced by the U-wall section under Segment 1A and have to be relocated.

A 14" line crosses the alignment at Berry Street and 7th. As with the 18" potable line above, Segment 1A will have no impact but Segment 1B will require rerouting.

Gas:

A 3" gas line runs down Townsend Street from 6th to 4th then increases to a 4" line from 4th to 3rd. This line runs in the center of the street and should be able to remain in place. A second 4" line runs along the north side of Townsend between 4th and 3rd which should also be unaffected by the cut-and-cover construction. Two 1" plastic pipe laterals branch off the 3" line between 5th and 4th to provide service to the south side of Townsend. These would have to be routed around the end of the U-wall and supported in place during construction.

A 16" cast iron pipe runs along the south side of Townsend Street between 4th and 3rd which will have to be relocated in the north side of Townsend. Alternatively, it could be hung along the side of the cut-and-cover excavation during construction then relocated in the south side of the street when Townsend is reconstructed. It is likely that PG&E would replace this line with a smaller diameter high pressure plastic line or eliminate it altogether.

A 3" high pressure plastic pipe crosses Townsend at 4th Street. This pipe will have to be supported in place during construction.

Electrical:

One medium and one large PG&E electrical vault will be displaced by the Townsend Street construction. Approximately 1,200' of active cable will be displaced along the south side of Townsend Street between 7th and 3rd. These lines would have to be rerouted through spare conduit in the north half of Townsend or through new conduit placed in the north side of the street.

Approximately 12 street lights and 5 traffic signal lights would be removed during construction of the U-wall and cut-and-cover sections. These would have to be replaced during street reconstruction.

Additional Department of Public Works (DPW) electrical ducts may be displaced by this construction although locations could not be verified at the time of this report.

Communications:

One small PacBell vault will be displaced in Townsend between 5th and 3rd. Approximately 3,800' of conduit will be displaced by the Townsend Street construction, although much of this is spare conduit. All of the conduit displaced is between 5th and 3rd.

In addition to the PacBell utilities, a Sprint fiber optic cable is believed to run along the south side of Townsend which will have to be relocated to the north side of the street. An MCI cable also runs along Townsend although the location could not be verified at the time of this report.

6.2 Segment 2

Location:

Segment 2 begins in Townsend Street just west of 3rd. It extends beneath 3rd Street then bends to the north, leaving Townsend just past 3rd and angling diagonally northeast beneath Stanford, 2nd and Brannan streets and ending just south of Bryant Street.

Proposed Construction:

Segment 2 will be constructed as a cut-and-cover tunnel section across 3rd to the point where it leaves Townsend. From Townsend to Bryant it will be a mined tunnel.

Existing Utility Impact:

The primary utility impacts for Segment 2 occur at the west end where it crosses 3rd in Townsend. The mined tunnel section between Townsend and Bryant should be deep enough that no utilities are impacted over this portion of the segment, assuming there is no significant settlement due to the tunnel construction.

In the cut-and-cover section, the most significant utility impact will be the two 3' X 5' brick sewers that cross at 3rd and Townsend. All other utilities impacted by Segment 2 are 20" or less in diameter.

Sewer:

Two 3' X 5' brick sewers intersect in a T-junction at 3rd and Townsend. One sewer runs down the center of 3rd Street and the second sewer runs up Townsend from 2nd ending at 3rd were it joins the 3rd Street sewer. Both sewers will have to be replaced with pipe sections and supported in place over the cut-and-cover excavation. Preferably, it may be possible to shift the T-junction north of the excavation in 3rd Street so that the junction box does not have to be supported over the cut-and-cover operation.

Approximately 3 storm drain inlets will have to be replaced at the intersection of 3rd and Townsend.

Potable Water:

Two 8" water mains cross in a 4-way junction at 3rd and Townsend. These should be realigned to move the junction north of the excavation. The crossing pipes will have to be supported in place during construction.

Auxiliary (Fire) Water:

A 14" and a 12" auxiliary water line intersect at 3rd and Townsend in a 90° elbow, the 14" line running north in 3rd and the 12" line running east in Townsend. The line will have to be supported in place over the excavation and sufficient lateral support provided to offset the horizontal thrust at the elbow. A hydrant lateral may also have to be supported in place which extends from the 12" main in Townsend to a hydrant at the south side of Townsend.

Gas:

Several gas lines currently converge at the intersection of 3rd and Townsend. A 16" cast iron line extends down Townsend from the west and turns north into 3rd street. A 10" cast iron line comes from the south on 3rd Street changing to a 6" line at Townsend and continuing north. An east/west line in Townsend intersects the 3rd Street line with a 6" line running east and a 4" line running west. A second 4" line takes off from the east/west 4" line going south on 3rd. Finally, a third 4" line branches west in Townsend from the 16" cast iron line.

The 6" line running east in Townsend, and the 10" and 4" lines running south in 3rd will have to be supported in place over the excavation. The 16" line may not be affected depending or whether it was moved to the north side of Townsend in Segment 1. The two 4" lines running west in Townsend should not be affected by the excavation. The intersection of the east/west Townsend line and the north/south 3rd Street line should fall to the north of the excavation.

Electrical:

Two medium size PG&E RC electrical boxes will be displaced by the cut-and-cover excavation at the intersection of 3rd and Townsend along with 1,900' of active conduit. It may be possible to reconstruct these boxes in the undisturbed portion of Townsend Street to the north or relocate their functions to other boxes. A percentage of the conduit will have to be supported in place over the excavation. Approximately 4 streetlights will have to be replaced at 3rd and Townsend. Additional DPW electrical ducts may also exist in Townsend and 3rd streets but locations could not be determined at the time of this report.

Communications:

At 3rd and Townsend, 1 medium and 1 small PacBell RC box will be displaced in addition to 800' of total conduit. As discussed in the electrical section, these boxes will have to be relocated outside the excavation if possible or supported along the side, and most of the conduit will have to be run along the side with some crossing the open excavation.

6.3 Segment 3

Location:

Segment 3 runs underground up Beale Street between Bryant and Market streets. It includes six options (3AC, 3BC, 3CC, 3AM, 3BM, 3CM). The A/B/C designates three different station configurations at the north end, and the C/M designates a cut-and-cover or mined tunnel connection at the south end. Segments 3AC, 3BC and 3CC begin in Beale Street just south of Bryant where Segment 5 ends. Segments 3AM, 3BM and 3CM begin west of Beale Street, just south of the intersection of Bryant and 1st streets, where Segment 2 ends. Segments 3AM, 3BM and 3CM curve to the north beneath Bryant Street then pass beneath the Bay Bridge approach ramps and Harrison Street before making a second curve to the north to enter Beale Street between Harrison and Folsom.

Station option A is the three-level/four-track station extending to Market Street, station option B is the two-level/four-track staggered station terminating at Market and Mission streets, and station option C is the two-level/four-track station terminating at Mission Street with a pedestrian walkway to Market Sreet.

Proposed Construction:

Proposed construction along Beale Street is cut-and-cover. The width of excavation will include most of the Beale Street right-of-way because of the width required for the station and the track widening leading into the station. Excavation width will be approximately 70' and the Beale Street right-of-way width is 82.5'.

The portion of Segments 3AM, 3BM and 3CM from 1st/Bryant streets to Beale Street, just north of Harrison, will be constructed by mined tunnel.

Existing Utility Impact:

The significant width of the excavation in Beale Street leaves little room for permanently relocating utilities adjacent to the excavation as was done in Townsend and King streets. The unexcavated portion would be beneath sidewalks which is an undesirable location for concentrated underground utilities because of greater difficulties in maintenance and repair. Also, between Mission and Market streets, existing basements occupy much of the area beneath the sidewalks on both sides of the street.

Most of the utilities that run longitudinally in Beale Street will have to be temporarily supported along the sides of the excavation during the cut-and-cover construction, then relocated back into the center of the street during street reconstruction. It may be feasible and provide a cost savings to leave some of the utilities permanently located where they are supported at the sides of the excavation. However, this

would depend on the method of cut-and-cover used and whether the supported locations would fall under restored sidewalks.

A unique utility impact in Segment 3 is a large, circular, underground water storage cistern located in Beale Street at Howard. The cistern is part of the Fire Department's auxiliary water supply system and is discussed under that section.

A large number of PG&E underground electrical vaults and PacBell communications vaults exist in Beale Street between Howard and Market along with a high density of conduit and duct banks. A significant coordination effort with PG&E and the adjacent building owners will be required to satisfactorily relocate these boxes and duct banks.

All other utility lines impacted along Beale Street are between 8" and 16" in diameter with the exception of three medium size sewers which cross Beale Street at Folsom, Howard and Mission. The sewers in Howard and Mission streets could be problematic because of the extra height of the station in this area.

The initial portion of Segments 3AM, 3BM and 3CM west of Beale Street will be a mined tunnel and no utility impacts are assumed. Additional utility impacts will occur in Beale Street for the initial portion of Segments 3AC, 3BC and 3CC. These are noted at the end of each utility section.

Sewer:

Two sewers run longitudinally in Beale Street. A gravity collector sewer ranging in size from 12" to 18" runs between blocks in the center of Beale, and a 10" sludge force main runs from Davis Street (north of Market) down Beale Street to Bryant then jogs over one block west to 1st.

The collector sewer will have to be supported along the side of the excavation during subway and station construction and then replaced in the center of the street during street reconstruction.

The 10" force main could be treated accordingly. However an alternative consideration for the force main would be to relocate it permanently in Main Street, reconnecting it to the original route at Market and Bryant streets. Assuming the force main could be located in Main Street, the advantages would be to reduce the number of utilities requiring support along the excavation and to require only one move of the force main.

Three sewers cross Beale Street between Harrison and Market: a 3' X 5' brick sewer crosses at Folsom; a 3' X 5' brick sewer crosses at Howard; and a 3.5' X 5.3' concrete sewer crosses at Mission. Invert elevations of the brick sewers are not known but the concrete sewer in Mission Street crosses Beale with an invert of

approximately -8'. All three sewers would have to be supported in place during construction and would require substantial supporting structures. The brick sewers would have to be replaced with new sections of circular pipe, probably 24" VCP.

The flow direction of all three sewers is easterly, from Fremont Street across Beale Street toward Main Street. If either the Mission Street or the Howard Street sewer was blocked by the height of the new station but not both, the blocked sewer could possibly be rerouted to the unblocked street by crossing over at Fremont Street. From there the two sewers would be consolidated in a single sewer crossing Beale in the unblocked street and continuing to Main and Howard where they are currently consolidated.

If both sewers are blocked by the station, they could possibly be rerouted south in Fremont to Folsom, cross Beale Street at Folsom, then be routed back up Main Street or continue east in Folsom to the large consolidation sewer in Steuart Street.

Approximately 18 service laterals would have to be reconstructed and supported in place over the cut-and-cover excavation along Beale Street. Approximately 26 storm drain inlets would have to be replaced when Beale Street is reconstructed.

For Segments 3AC, 3BC and 3CC, two additional sewers cross Beale Street: a 12" sewer crosses at Harrison and a 24" sewer crosses at Bryant. Both will have to be supported in place during construction. Four additional service laterals will have to be supported across the excavation and 8 additional storm drain inlets will have to be replaced.

Potable Water:

A single 12" water main runs in Beale Street between Bryant and Market which would have to be supported along the side of the excavation during construction, then replaced in the middle of the street. Approximately 18 service laterals would have to be reconstructed between Harrison and Market with about half of those supported in place across the excavation.

Four water mains cross Beale Street between Harrison and Market: an 8" and a 20" line at Folsom; an 8" line at Howard; and a 12" line at Mission. All four will have to be supported in place across the excavation. Junctions with the 12" longitudinal line in Beale will have to be specially supported over the excavation or moved to the side during construction then back again.

For Segments 3AC, 3BC and 3CC, two additional water mains are impacted. A 12" main crosses Beale Street at Harrison and will have to be supported in place as above. At Bryant Street, an 8" main from the east terminates at the 12" main in Beale Sreet. If the 12" main is supported along the west wall the 8" line will have to

be supported in place over the excavation. Four additional service laterals will have to be supported across the excavation.

Auxiliary (Fire) Water:

A single auxiliary water main enters Beale Street from the west in Bryant Street and runs up Beale Street from Bryant to Market. It is 16" in diameter from Bryant to Harrison, 14" in diameter from Harrison to Howard, and 10" in diameter from Howard to Market. This line will have to be temporarily supported along the side of the excavation like the potable water line described above. A 12" main running west in Folsom terminates at the Beale Street main in a T-junction, and 14" and 12" mains cross with 4-way junctions at Howard and Mission streets. These will have to be supported in place across the excavation. Two 8" hydrant laterals will also have to be extended and supported in place over the excavation.

A 35' diameter by 24' deep RC auxiliary water storage cistern is located in Beale Street at Howard. The cistern cannot be taken out of service but it can be relocated nearby. A cistern would have to be built at the new site first and then the Beale Street cistern could be demolished and removed. A new cistern could possibly be located one block over in Fremont Street at Howard.

Gas:

A 16" cast iron gas main enters Beale Street at Folsom and runs up to Market where it ties in to a 24" line. This 16" line will most likely be taken out of service by PG&E and replaced with a smaller diameter high pressure plastic line. This line would have to be supported along the side of the excavation during construction. If service can be adequately provided from side streets, the line may be eliminated altogether.

A 4" high pressure plastic line runs up Beale Street from Bryant to Folsom. This line would have to supported along the side of the excavation. An 8" cast iron line running east in Folsom Street and a 3" high pressure plastic line running east in Howard Street terminate at Beale Street with ties to the Beale Street mains. At Mission Street a 3" high pressure plastic line runs west and an 8" cast iron line runs east, both terminating at the 16" Beale Street main. Approximately five 1"-2" side laterals branch off the Beale Street main to service adjacent buildings between Harrison and Market streets.

For Segments 3AC, 3BC and 3CC, an additional 2" high pressure plastic line crosses Beale Street at Bryant. This line would have to be supported in place across the excavation.

Electrical:

An extensive number of underground electrical vaults and connecting conduit are located in Beale Street, particularly between Howard and Market. By block there are: 3 large, 1 medium, and 1 small RC boxes and 4,400' of active conduit in Beale Street between Folsom and Howard; 5 large, 2 medium, and 3 small RC boxes and 7,400' of active conduit in Beale between Howard and Mission; and 9 large, 2 medium, and 4 small RC boxes and 8,900' of active conduit in Beale between Mission and Market. The relocation and rerouting of this volume of electrical equipment will take extensive planning and coordination with PG&E and local building owners. It may be possible to support some boxes along the sides of the excavation, but most boxes will probably have to be relocated in adjacent cross streets. A large volume of conduit will likely need to be supported along the sides of the excavation and across the excavation at several points.

Approximately 34 streetlights and 14 traffic signals will have to be replaced in Beale Street. Additional DPW electrical duct work exists in Beale Street but the quantity could not be determined at the time of this report.

For Segments 3AC, 3BC and 3CC, additional facilities in Beale Street between Bryant and Harrison include: 2 medium and 2 small RC boxes and 870' of active conduit, 8 streetlights, and 6 traffic signals.

For Segments 3CC and 3CM, three of the large RC vaults listed above between Mission and Market streets could remain in place.

Communications:

A large quantity of PacBell boxes and conduit also exists in Beale Street. By block there are: 2 medium boxes and 3,900' of total conduit between Folsom and Howard; 2 medium and 5 small boxes and 10,000' of total conduit between Howard and Mission; and 1 large and 5 medium boxes and 13,000' of total conduit between Mission and Market.

AT&T has an optical cable running in Beale Street from Folsom to Market in PacBell conduit. An MCI cable is believed to cross Beale Street at Folsom, but the crossing could not be verified at the time of this report.

As with the electrical utilities, the relocation and rerouting of PacBell's communications systems will require extensive planning and coordination.

6.4 Segment 4

Location:

Segment 4 runs underground below Townsend Street from 3rd Street to the Embarcadero. It begins just west of 3rd Street, includes the 3rd Street intersection, and terminates in the Embarcadero just north of the intersection of Townsend, Delancey (1st), and the Embarcadero. The Segment 4 alignment is located south of the Townsend Street centerline for the entire length.

Proposed Construction:

Proposed construction is cut-and-cover box tunnel for the entire length of Segment 4. Because the alignment is offset to the south, the cut-and-cover excavation should leave at least 30' along the north side of Townsend Street undisturbed.

Existing Utility Impact:

The most significant utility impacts in this segment are a 3' X 5' brick sewer and a 5' diameter saltwater intake tunnel for the AWSS, both running down Townsend. The intake tunnel is located in the north side of Townsend and the proposed alignment is routed in the south side to avoid it, but the intake tunnel crosses the alignment at the Embarcadero.

PG&E has numerous facilities in Townsend between 3rd and 1st requiring a moderate displacement of underground electrical boxes and duct routes there.

All of the utilities running longitudinally in Townsend between 3rd and 1st lie in the north half of the street, so the impact from the tunnel alignment running in the south portion of the street is reduced.

Sewer:

A 3' x 5' brick sewer runs down Townsend between 3rd and 2nd, and a 21"/24" sewer runs down Townsend between 2nd and the Embarcadero, changing from 21" to 24" where an 18" sewer joins it at Colin P. Kelly. This entire length of sewer will have to be relocated during construction.

It may be possible to permanently relocate it in the north undisturbed portion of Townsend, but if not, it will have to be supported from the side of the excavation. It may be possible, depending on exact construction techniques used, to relocate the sewer once on the north wall of the excavation and then leave it there permanently when the construction is completed. The 3' x 5' brick segment between 3rd and 2nd will most likely have to be replaced with a 21" VCP when it is relocated.

Approximately 28 service laterals branch off of this longitudinal line between 3rd and 1st and about half of these will need to be supported across the open excavation.

Another 3' x 5' brick sewer crosses Townsend at 3rd. This sewer will have to be replaced by a section of VCP or RCP circular pipe and supported in place across the excavation.

An 18" VCP sewer empties into the Townsend longitudinal sewer at 2nd from the north, and an 8" VCP continues south down 2nd on the other side. Presumably, the longitudinal line flowing east in Townsend can pick up the flow from the 18" line and the 8" VCP could simply begin on the south side of the excavation in 2nd Street and a line wouldn't have to be supported in place across.

At 1st Street, the 24" Townsend longitudinal sewer crosses the Embarcadero to empty into a 30" x 45" sewer and will need to be supported across the cut-and-cover excavation. Likewise, an 18" VCP sewer running down 1st empties into the Embarcadero sewer and will need to be supported in place across the excavation.

The above mentioned 30" x 45" sewer and a 17.5' wide box consolidation sewer both run along the Embarcadero, flowing south towards the Channel Pump Station, but both are east of the planned alignment and should not be disturbed by the cut-and-cover construction.

In addition, approximately 6 storm drain inlets along the south side of Townsend will have to be replaced when the street is reconstructed.

Potable Water:

An 8" water main runs in the north side of Townsend between 3rd and 1st. Exact distance from the right-of-way could not be determined at this time, but it may run far enough north that it could remain in place and not be impacted by the cut-and-cover construction. It crosses over to a 12" line in the Embarcadero near 1st and would have to be supported in place over the excavation at that point. If the line is in fact far enough south that it is impacted by the tunnel construction it could be permanently relocated farther north in Townsend or temporarily hung from the side of the excavation during construction. Approximately 10 service laterals branch off this line to the properties on the south side of Townsend. They would have to be supported in place over the excavation.

Two 8" water lines cross Townsend, one at 3rd and one at 2nd. these would have to be supported in placed during construction.

A 12" and an 8" water line run in the west half of the Embarcadero, with the 8" line running east of the 12" line. The tunnel alignment is planned to run along the very west edge of the Embarcadero so it should miss the 8" line, but the 12" line will

probably be displaced by the cut-and-cover excavation. The 12" line can be supported along the east wall of the excavation and possibly left in this location when construction is completed. A short 8" link line connects across between the 12" and 8" lines near 1st Street. The T-junction with the 12" line would have to be supported in place with the 12" line and appropriate lateral support provided to offset the horizontal thrust.

Auxiliary (Fire) Water:

Segment 4 passes near one of the Fire Department's saltwater intake pump stations. The pump station is located on the northwest corner of 2nd and Townsend. A 5' diameter RC intake tunnel runs from the pump station down the north side of Townsend Street (centered 25' in from the right-of-way line) to 1st Street then crosses the Embarcadero to a saltwater intake structure below the wharf. Two 20" mains connect the pump station to the auxiliary water supply system, one exits the pump station into 2nd Street and runs north up 2nd, and the other exits the station into Townsend Street, runs a short distance west in Townsend, then turns north up Stanford Street.

A 12" main continues west from the 20" line in the north side of Townsend to 3rd Street where it also turns north, becoming a 14" line in 3rd Street. Two laterals branch south off of this line to hydrants on the south side of Townsend, and one lateral branches north to a hydrant near Stanford Street.

A second 12" line continues east from the 20" line in Townsend, intersecting with a 12" line running north in 2nd Street. Both 12" lines currently terminate at the far sides of the street intersection. One lateral branches off the 12" line in Townsend to a hydrant at the northwest corner of 2nd and Townsend.

The Segment 4 alignment will most likely impact the 20"/12" line running in Townsend between 3rd and 2nd, however, it is routed to stay south of the 5' intake tunnel. It may be possible to permanently relocate the 20"/12" line north of the excavation limits in Townsend so it would not have to be moved twice. The two hydrants on the south side of Townsend will be displaced by the excavation. It may be possible to leave them out of service during construction, or if not, permanently or temporarily locate then on the north side of Townsend. It is assumed that the 12" line terminating across Townsend at 2nd could be terminated north of the excavation during cut-and-cover construction and re-extended afterwards if necessary.

The 5' diameter intake tunnel crosses the alignment at the Embarcadero. The invert at this point is approximately -21.3'. The current alignment profile here puts the top of the subway structure at about -15'. The profile would have to be lowered about 8 feet to clear below the intake tunnel and a temporary supporting structure. If the subway profile cannot be lowered sufficiently to clear below the intake tunnel, the

intake tunnel can be raised. However, the tunnel supplies sea water to the pump station by gravity flow and the mean low water elevation of the bay is approximately -14' so the invert of the intake tunnel can only be raised to approximately -19'. This would require lowering the alignment profile at least 6'.

Gas:

Several gas lines converge at the intersection of 3rd and Townsend. See Segment 2 - Gas for a discussion of the gas line impact at this intersection. The only difference that would apply to Segment 4 is that the 6" cast iron line running east in Townsend Street may be located far enough north that it is not impacted by the cut-and-cover excavation.

This 6" cast iron line becomes a 4" cast iron line between 2nd and 1st and shifts farther to the south. It crosses over at 1st Street to a 6" cast iron line in the Embarcadero. A 6" cast iron line crosses with this line at 2nd Street and a 2" line branches north from this is line up Colin P. Kelly Street. PG&E may plan to replace all of these lines with high pressure plastic pipe in conjunction with the CalTrain construction. If the 6"/4" line in Townsend is not far enough north it will have to be relocated or temporarily supported along the side of the excavation. When it crosses over to the Embarcadero at 1st it will have to be supported in place over the excavation. The 6" line crossing at 2nd will also have to be supported in place over the excavation.

Approximately eight 1" plastic service laterals cross Townsend Street to properties on the south side between 3rd and 1st and will have to be supported in place over the excavation.

Electrical:

PG&E has 2 large, 5 medium, and 7 small RC boxes and approximately 2,900' of active conduit underground in the impacted portions of Townsend Street between 3rd and 1st. The boxes will have to be relocated in the north side of the street if possible or temporarily supported along the sides of the excavation, and the active cable rerouted through undisturbed spare conduits or new conduit laid in the north side of Townsend. At strategic points, conduit will have to be supported in place across the excavation to service locations on the south side of Townsend.

Approximately 14 street lights and 6 traffic signals will be displaced by the construction and have to be replaced afterwards.

Some DPW electrical ducts and boxes may also be impacted by the work.

Communications:

PacBell has 2 medium and 9 small RC boxes impacted by the planned alignment along with 3,600' of total conduit. Relocation would be similar to the electrical relocation discussed above.

6.5 Segment 5

Location:

Segment 5 continues from the end of Segment 4 or 12 and runs underground along the west edge of the Embarcadero from Delancey Street (1st Street) to Beale Street. At Beale and Embarcadero it swings to the left, arcing under a parking lot just east of Beale Street and ending in Beale Street at Bryant.

Proposed Construction:

Proposed construction of the box tunnel is cut-and-cover for the entire length of Segment 5. Along the Embarcadero the width of the excavation will be about 40'. As the alignment swings into Beale Street the excavation begins to widen to about 70' because the double tracks begin to split into four as they approach the Beale Street station.

Existing Utility Impact:

The most significant utility impacts in Segment 5 are two large sewer crossings. A 7.5' X 6' RC sewer and a 2.5' X 3.8' RC sewer cross Segment 5 in the Embarcadero at the intersection of Brannan and Beale. However, the current alignment profile will clear below both of these sewers.

All other impacted utilities are less than 20" in size.

Sewer:

No sewer lines should be impacted by the cut-and-cover excavation in the Embarcadero between Townsend and Brannan. A 17.5' wide box sewer and a 2.5' X 3.8' sewer run down the Embarcadero east of the proposed alignment but should be well clear of the excavation.

As the alignment passes the intersection of Beale, Brannan and the Embarcadero it crosses under two large sewers which empty into the 17.5' box consolidation sewer: a 7.5' X 6' RC semi-circular sewer with an invert of -11.5' which runs down Brannan Street; and a 2.5' X 3.8' RC elliptical sewer with an invert of -11.4' which runs down Beale Street from Bryant. Both sewers will have to be supported in place over the cut-and-cover excavation with fairly substantial supporting structures. The 7.5' X 6' sewer, in particular, will need a large bridge to support it. The alignment is located just east of Beale Street between the Embarcadero and Bryant, so the 2.5' X 3.8' sewer running down Beale from Bryant will not be further impacted.

Finally, about 6 storm drain inlets and connection lines will be displaced by the excavation in the Embarcadero and have to be replaced.

Potable Water:

The primary water line impacted by the Segment 5 excavation is a 12" main which runs up the Embarcadero then turns and runs up Beale Street. It will have to be temporarily supported along the side of the excavation during construction. Approximately 3 service laterals will have to be supported across the excavation.

In addition, two 8" mains cross the alignment which will have to be supported in place. An 8" water line ties into the 12" main from Brannan Street and then, just up the line, another 8" connector jogs over to an 8" line further east in the Embarcadero. One of these 8" lines will have to be supported across the excavation depending on which side the 12" line is supported.

Auxiliary (Fire) Water:

There are no auxiliary water lines located in the Embarcadero.

Gas:

A 4"/6" gas line runs along the Embarcadero, but it should be located far enough east that it is not impacted by the Segment 5 excavation. Another 4" line runs along Brannan Street and turns up Beale Street at the Embarcadero. This line will be exposed by the excavation just where it turns the corner because Segment 5 runs against the west right-of-way line here. It will have to be supported along the west wall for a short distance.

Electrical:

There is no known PG&E electrical activity in the Embarcadero between Townsend and Beale. Approximately 6 street lights and 6 traffic signals will be displaced by construction and have to be replaced.

Some additional DPW electrical boxes and duct work probably exist in the Embarcadero but the locations could not be determined at the time of this report.

Communications:

There is no known Pacific Bell equipment in the Embarcadero between Townsend and Beale.

6.6 Segment 6

Location:

Segment 6 has two options, 6A and 6B. Segment 6A begins at the intersection of 16th and 7th streets. It extends north along the surface on the east side of 7th in the existing CalTrain right-of-way. At Berry Street it begins descending and turning to the right, crosses 6th Street diagonally, enters a portal just east of 6th, then completes the turn underground and runs underground parallel to King Street. The alignment is located just north of the proposed improvements to King Street between 6th and 5th streets then reenters the current King Street right-of-way east of 4th and runs along the north half of King Street between 4th and 2nd. It ends at King and 2nd streets, just west of the intersection.

Segment 6B is identical to 6A except that it descends underground earlier in the alignment. The U-wall transition section begins at Irwin Street, the alignment descends along 7th Street, and the portal is located at 7th and Berry streets.

Proposed Construction:

Segment 6 from 16th Street to Irwin or Berry will be constructed on grade. From Irwin to Berry or Berry to 6th, a permanent retained cut U-wall section will be built. From Berry or 6th to 2nd Street a box tunnel subway will be built by cut-and-cover.

Existing Utility Impact:

If Segment 6A is used, no utility relocation will be required along 7th Street up to Berry Street since the route runs at-grade in the CalTrain right-of-way. However, some reinforcement of existing utilities crossing under the CalTrain right-of-way may be required where new track is installed. Utilities crossing in Berry and 6th streets will have to be rerouted because of the permanent U-wall section. Utilities located in the north side of King Street between 5th and 2nd and those crossing King Street will have to be relocated or supported in place during cut-and-cover construction, then reburied during street restoration after construction of the tunnel is complete. These utilities generally cannot be relocated in the south side of the street because of the existing and soon to be constructed Muni light rail facilities running down the center of King Street.

If Segment 6B is used, utilities crossing 7th Street between Irwin and Berry streets will have to be rerouted because of the U-wall, and utilities crossing King Street at 6th will be treated the same as the rest of King Street described above.

The significant utilities impacted in Segment 6 are five large sewers draining much of the Mission district, upper Market Street and downtown areas. They cross the alignment at 7th/Berry, and in 4th, 5th and 6th streets. Relocation and protection of

these sewers will require extensive study, planning and coordination with the San Francisco DPW.

Sewer:

Segment 6 crosses the Division Street outfall sewer at 7th and Berry streets. This large structure consists of four RC box sewers, each 9'-6" X 8'-3", emptying into the Channel Pump Station at the upper end of the China Basin Channel. The current Segment 6A profile crosses over this structure at-grade and no impact is assumed. If Segment 6B is used however, the profile will be descending along 7th Street at this point, bisecting the sewer, and the sewer would have to be relocated. During a previous study of CalTrain improvements, the DPW did a preliminary investigation of lowering the Division Street outfall sewer and concluded that the sewer could probably be lowered to pass under a subway section. The current invert of the sewer is approximately -11 feet. The bottom of the U-wall structure would be at approximately -27 feet at the sewer crossing. The invert of the pump station floor is approximately -35 feet. The sewer would have to be lowered and widened to pass through the 8 feet remaining between the bottom of the retained cut U-wall section and the pump station floor. It is likely that 8' will not be sufficient room for a reconstructed sewer. The profile will probably have to be raised several feet to provide a minimum acceptable clearance. Hydraulic modeling studies would have to be performed to verify that a change in the grade line would not cause flooding upstream. Relocation of the Division Street outfall sewer would be a major alteration to the existing system and would require a significant coordination effort with the Department of Public Works.

A 10' X 7' RC semi-circular sewer with an invert of -12.6', and a 6' diameter RC circular sewer with an invert of -11.2' cross King Street at 6th. Both structures are on piles. Segment 6A will block both of these sewers with the U-wall. Segment 6B will be in full subway section by 6th Street but it will not be low enough yet to clear below these sewers. With either segment both sewers will have to be relocated. A possible relocation plan would be to combine both sewers at 6th and Townsend and reroute this new consolidated sewer west in Townsend (or Bluxom) to 7th then south in 7th Street to pass under the alignment with the Division Street outfall sewer at 7th and Berry.

A 9' X 7' RC semi-circular sewer with an invert of -13' crosses King Street at 5th. Segments 6A and 6B will both be too high to clear beneath this sewer. With either segment it will have to be relocated. This sewer could possibly be rerouted west in Townsend Street to 6th, consolidated with the two sewers in 6th Street, and rerouted on to 7th Street as described above.

Two new sewers are currently planned for 5th Street as part of the Muni extension project. A 23' (wide) X 2' (high) RC box storm drain with an invert of approximately -7.5' at King Street will run down 5th Street from Townsend to Berry. An 18" ductile

iron pipe (DIP) storm drain with an invert of approximately -12' at King Street will also run down 5th Street from Townsend to Berry. Both are intended to relieve storm flooding problems in Townsend between 4th and 6th streets. The entire length of 18" storm drain and the section of 23' X 2' storm drain crossing King Street will be constructed under the Muni extension contract. Segments 6A and 6B will both be at about the same elevation at 5th Street. The top of the subway structure will be at approximately -10'. With either segment, the 23' X 2' storm drain will be high enough to pass over the top of the subway but the 18" pipe will be blocked by the top of the subway. The 23' X 2' storm drain could possibly be supported in place, but if it is still not completed north of King Street it may be easier to remove the portion above the cut-and-cover excavation and rebuild it after construction. The 18" pipe will have to be rerouted. It may be possible to run the 18" pipe west in Townsend and combine it with the other large sewers discussed above.

A 6.5' diameter brick-lined RC circular sewer on piles with an invert of -10' crosses King Street at 4th. The alignments of both Segments 6A and 6B should just clear beneath this sewer allowing it to be maintained in place. However, the profile may have to be adjusted downward slightly to provide complete clearance. During cut-and-cover construction, a bridge structure would have to be built to support the sewer in place over the open excavation.

A 21" VCP sewer with an unknown invert, and a 30" sludge force main with an invert of -7' also cross King Street at 4th. These pipes can remain in place and will have to be supported over the open excavation for either Segment 6A or 6B.

A 3' X 5' brick sewer crosses King Street at 3rd but the invert elevation is not known. The top of the subway structure here is at approximately -13'. This is probably low enough to allow the sewer to remain in place, but it will most likely have to be replaced with VCP or lined RCP before it is supported over the excavation.

Finally, a 15" VCP sewer runs down the center of King Street between 2nd and 3rd. This sewer will have to be temporarily supported along the side of the excavation and some service laterals supported across the excavation. After construction it would have to be relocated in the center of the street.

A 17.5' wide RC box consolidation sewer runs up King Street, just south of centerline between 2nd and 4th. The proposed alignment is routed along the north side of King Street to avoid this large sewer completely, but special construction techniques may be required to support the sewer during construction of the subway.

Approximately 8 storm drain inlets will be displaced during construction in King Street between 6th and 2nd. They will need to be replaced when the King Street surface is reconstructed.

Potable Water:

An 18" steel water main in Berry Street crosses the alignment at 7th. Both Segment 6A and 6B will block the line with the U-wall section. For Segment 6A the line should be rerouted south around the beginning of the U-wall section and sleeved where it will pass under the at-grade track. For Segment 6B the line should be rerouted north around the back of the portal and above the subway box. This line would then have to be supported over the excavation during construction.

A 12" water main crosses King Street at 4th, and 8" water mains cross King Street at 5th and 3rd. All three will have to be supported in place during construction.

An 8" water main is located in the north half of King Street between 3rd and 2nd. This line will have to be temporarily supported along the side of the excavation. Approximately 9 service laterals branching off of this line along King Street will have to be reconstructed. Those crossing over King Street will have to be supported in place during construction.

Auxiliary (Fire) Water:

A 14" line in Berry Street crosses under the alignment near 7th. This line will have to be rerouted around the U-wall just as described for the 18" steel water line above.

Three 12" lines cross King Street at 6th, 5th, and 4th streets. Each of these will have to be supported in place during construction. The 12" line in 6th Street will have to be rerouted east around the back of the portal if Segment 6A is used since the U-wall section extends across 6th Street.

Gas:

A 3" high pressure plastic gas line crosses King Street at 4th, and a 4" line crosses King Street at 3rd. Both of these lines will have to be supported in place during construction.

A 10" cast iron line runs down 3rd Street and terminates at the south side of King Street. This line can probably be terminated at the north side of King Street and thus no longer pose an interference to the alignment.

A 2" plastic line runs down King Street between 3rd and 2nd. This line will have to be temporarily supported along the side of the excavation.

Electrical:

PG&E has very little underground electrical utilities in King Street between 7th and 3rd. However, from 3rd to 2nd there are 4 small RC boxes, 1 medium RC box, and

approximately 2600' of active cable that would be displaced by the cut-and-cover construction. These cables will have to be rerouted through existing spare conduit on the south side of King Street or placed in new conduit. Additional new boxes may have to be built in 2nd and 3rd streets.

Some service connections will have to be supported in place or strung overhead on poles across King Street during construction.

Approximately 28 street lights and 8 traffic signals will have to be replaced on King Street between 7th and 2nd. Additional DPW electrical ducts may be displaced on King Street although locations could not be determined at the time of this report.

Communications:

Five small PacBell RC boxes and 800' of conduit will be displaced in King Street between 3rd and 2nd. The amount of the conduit carrying active wires could not be determined at the time of this report.

6.7 Segment 7

Location:

Segment 7 begins in King Street just west of 2nd. It crosses 2nd Street and begins a 90° turn to the north passing beneath Townsend Street and entering Colin P. Kelly Jr. Street. It continues north under Colin P. Kelly, crosses beneath Brannan Street, and ends just south of Bryant Street where Segment 8 begins.

Proposed Construction:

Proposed construction will be cut-and-cover box tunnel for the entire length of Segment 7.

Existing Utility Impact:

The primary utility impacts in Segment 7 will occur where it crosses 2nd, Townsend and Brannan streets. At these locations, the most significant utilities impacted are the 5' saltwater intake tunnel crossing in Townsend Street and a 7.5' X 6' sewer crossing in Brannan Street.

Sewer:

A longitudinal 18" VCP collector sewer runs down Colin P. Kelly Street from Brannan and empties into the Townsend Street sewer. Segment 7 will cross Townsend and run the entire length of Colin P. Kelly so this sewer will have to be relocated. The sewer will have to be temporarily supported from the side of the excavation along Colin P. Kelly and service laterals to adjacent buildings supported across the excavation. Approximately 6 service laterals branch off the 18" line in Colin P. Kelly. A 21" ISP sewer running down Townsend changes to a 24" ISP when the Colin P. Kelly sewer joins it. The Townsend line will have to be supported in place across the excavation. It may be possible to support the junction box in place (where the 18" line ties in), but if not it will have to be moved to the side of the excavation and supported there.

Several other sewers cross Segment 7 and will have to be supported in place over the cut-and-cover excavation. Most significant is the 7.5' X 6' RC semi-circular sewer with an invert of -11' which crosses in Brannan Street. This sewer will require a major bridge structure to support it. The top of the subway structure here is at approximately -15' so there is not a lot of clearance between the sewer and the subway. The other two sewers which cross Segment 7 are an 8" VCP gravity line crossing at 2nd Street and a 10" sludge force main which crosses at Brannan.

Approximately 8 storm drain inlets will be displaced over the length of Segment 7 and have to be replaced.

Potable Water:

A 2" water line runs up Colin P. Kelly from Townsend, about half way to Brannan. This line will have to be supported along the side of the excavation to continue water service to buildings along Collin P. Kelly. Some service laterals may have to be supported across the excavation.

Three 8" water mains cross Segment 7 perpendicularly and will have to be supported in place across the excavation, one each at 2nd Street, Townsend Street, and Brannan Street.

Auxiliary (Fire) Water:

The 5' diameter saltwater intake tunnel crosses the alignment at Townsend with an invert of approximately -22'. The current alignment profile here puts the top of the subway structure at about -16'. The profile would have to be lowered about 8 feet to clear below the intake tunnel and a temporary supporting structure. If the subway profile cannot be lowered sufficiently to clear below the intake tunnel, the intake tunnel can be raised. However, the tunnel supplies sea water to the pump station by gravity flow and the mean low water elevation of the bay is approximately -14' so the invert of the intake tunnel can only be raised to approximately -19'. This would require lowering the alignment profile at least 5'.

A 16" main crosses the alignment at Brannan Street and will have to be supported in place over the excavation.

Gas:

A 2" plastic gas line runs down Colin P. Kelly Street from Brannan to Townsend. This line will have to be supported along the side of the excavation. Three gas lines cross Segment 7 and will have to be supported in place over the excavation, a 6" line at 2nd, a 4" line at Townsend, and a 6" line at Brannan.

Electrical:

The only PG&E electrical equipment impacted by this segment are 2 small RC underground boxes displaced in Colin P. Kelly Street and about 300' of active conduit in Colin P. Kelly. See Segment 10 - Electrical for comments.

Approximately 8 street lights and 4 traffic signals will have to be replaced due to the Segment 7 excavation.

Communications:

Four small PacBell RC boxes and 1,000' of total conduit are displaced by the excavation in Colin P. Kelly. These will have to be supported along the sides of the excavation.

6.8 Segment 8

Location:

Segment 8 begins just south of Bryant Street between 1st and 2nd streets, runs underground from Bryant to Folsom, and ends just south of Folsom. It runs parallel to 2nd Street under private property just west of Essex Street. It will either climb up from underground to meet Segment 9A which becomes an elevated structure just past Folsom or it will remain deep to meet Segment 9B which continues underground.

Proposed Construction:

Proposed construction for the entire length of Segment 8 is mined tunnel.

Existing Utility Impact:

There are no known utility impacts in Segment 8. The mined tunnel is deep enough that no utilities are impacted by this segment, assuming there is no significant settlement due to the tunnel construction. A 3' X 5' brick sewer is located in Bryant Street but the mined tunnel should be safely below the sewer. All other utilities in Bryant will be well above the top of the tunnel. A 230 kV high voltage underground power line runs in Harrison Street but this line will also be well above the top of the tunnel.

As there are no further utility impacts due to Segment 8, a utility-by-utility breakdown is not given.

6.9 Segment 9

Location:

Segment 9 extends from the end of Segment 8 just south of Folsom Street, crosses Folsom, Clementina, Tehama, and Howard Streets and curves 90° to the east across Natoma Street into the Transbay Terminal site. Segment 9 has two options, 9A and 9B. Segment 9A would exit from underground in a portal just north of Folsom Street and climb to an elevated structure crossing over Howard Street and continue aboveground to a second level station at the Transbay Terminal (extending over 1st and Beale streets). Segment 9B would continue underground from Folsom Street passing beneath Howard Street to an underground station at the Transbay Terminal (extending beneath 1st and Beale streets).

Proposed Construction:

Segment 9A will require three types of construction. The underground portion across Folsom Street will be constructed as a cut-and-cover subway, the transition portion from the portal to the elevated structure will be a retained cut U-wall section, and the remainder of the segment will be an aerial structure supported on columns. Segment 9B will be constructed by mined tunnel across Folsom Street then by cut-and-cover for the remainder.

Existing Utility Impact:

If Segment 9 is located above ground as an elevated structure to the Transbay Terminal (Segment 9A) there would be very little impact to underground utilities past Howard Street. Column foundations would be set below ground, but columns would not be located in the streets where most of the utilities are located. Exact locations of columns for an elevated structure are not known at this time, so no further information regarding utility impacts for Segment 9A past Howard Street can be given. A critical utility impact under Segment 9A is a 230 kV power line running underground in Folsom Street. See the Electrical section for further discussion.

If Segment 9 is located below ground in a tunnel section (Segment 9B), the cut-and-cover construction would impact underground utilities from Clementina Street to the end of the station at Beale Street. Primary utility impact would be at street crossings because Segment 9 runs mid-block, between 1st and 2nd and between Mission and Howard.

Sewer:

Segment 9A would impact 3' X 5' brick sewers in Folsom and Clementina streets. Both would be blocked: the Folsom street sewer would be blocked by the top of the subway and beginning of the portal structure and the Clementina Street sewer

would be blocked by the U-wall section. Both would have to be rerouted. The surface terrain in this area slopes down to the east and to the north. Possible reroutes would be: (1) reverse direction and run sewers back to 2nd Street; or (2) build new sewer parallel to and just west of the Segment 9A alignment to route flow from Folsom and Clementina streets down to Howard Street where it could be routed under the aerial structure and join the Howard Street sewer.

Segment 9B would clear below the Folsom and Clementina street sewers. But the Clementina Street sewer would have to be replaced by a section of circular pipe and supported over the cut-and-cover excavation. The Folsom Street sewer should not be impacted by the mined tunnel.

Segment 9B will also impact 3' X 5' brick sewers in Tehama, Howard, Natoma and 1st streets, 12" VCP sewers in Fremont and Beale streets, and a 10" sludge force main in Beale Street. Exact inverts are not known for any of these sewers. The primary collector sewers in this area are the sewers running down Howard and Mission streets. The sewers in Tehama and Howard streets may be high enough to clear over the top of the subway. In this case they would just need to be replaced by circular pipe and supported over the excavation. If not, they could probably be rerouted back to 2nd Street and down 2nd Street to the collector sewer in Mission. If the Mission Street sewer could not handle the additional flows a second sewer would have to be constructed down Mission Street and over on Main Street to Howard and Main. The sewers in Natoma, 1st, Fremont and Beale will most likely all have to be rerouted. This would entail rebuilding the sewers in each street and reversing the flow direction so they flowed away from the Segment 9B alignment towards 2nd, Mission or Howard streets. The 10" force main in Beale Street could probably be rerouted over the top of the station structure and would have to be supported in place during construction. All of this would require carefully study by and coordination with the San Francisco DPW.

Potable Water:

A 20" water main and a 6" water main cross the alignment in Folsom Street. Under Segment 9A these lines may have to be rerouted to the south side of Folsom Street and raised to clear over the portal. They would have to be supported in place over the cut-and-cover excavation. Under Segment 9B they should not be impacted by the mined tunnel.

A 4" line in Clementina would be blocked by the Segment 9A U-wall section. It is possible that this line could be severed and capped on each side of the U-wall. If not it would have to be rerouted around the north end of the U-wall. Segment 9B will clear below this line but it would have to be supported in place over the excavation.

No further water lines should be impacted by Segment 9A as it is aerial past

Clementina Street. The following additional water lines would be impacted by Segment 9B: a 6" line in Tehama Street, an 8" line in Howard Street, a 4" line in Natoma Street, an 8" line in 1st Street, an 8" line in Fremont Street, and a 12" line in Beale Street. Many of the lines might need to be raised to clear over the top of the subway and station structures and all would have to be supported in place during cut-and-cover construction.

Auxiliary (Fire) Water:

A 12" auxiliary water line runs down Folsom Street. Under Segment 9A this line will probably have to be rerouted to the south side of the street and raised to clear above the portal structure, then supported in place over the cut-and-cover excavation. Under Segment 9B this line will not be impacted by the mined tunnel.

Three additional auxiliary water lines cross the Segment 9 alignment but will only be impacted by Segment 9B. They are a 12" line in Howard Street, a 10" line in 1st Street, and a 10" line in Beale Street. The Howard Street line can probably remain in place but the 1st and Beale street lines may have to be raised to clear over the top of the station. All three will have to be supported over the cut-and-cover excavation.

Gas:

Two cast iron gas mains cross Segment 9 at Folsom Street, a 16" line and a 6" line. Under Segment 9A both lines may have to be rerouted to the south side of the street and raised to clear over the portal and will have to be supported over the excavation. Under Segment 9B there will be no impact from the mined tunnel.

A 2" gas line running in Clementina will have to be rerouted around the end of the U-wall section in Segment 9A. Under Segment 9B it can remain in place but will have to be supported over the excavation.

The remaining gas lines are impacted by Segment 9B only and include a 4" line in Tehama Street, two 2" lines in Howard Street, a 2" line in 1st Street, a 3" line in Fremont Street, and a 16" cast iron line in Beale Street. Some of the lines may need to be raised to clear over the top of the station. All will have to be supported over the cut-and-cover excavation.

Electrical:

A 230 kV high voltage PG&E power line runs underground in Folsom Street. The height of the portal structure under Folsom Street may require that this line be moved. This is a very sensitive line and would require special attention by PG&E both to move it and to support in place during construction. The mined tunnel of Segment 9B should clear below this line but special care would have to be taken to

ensure that it was not impacted or struck by equipment. Two additional PG&E duct banks, one 12-conduit and one 6-conduit, cross the alignment in Folsom Street. Under Segment 9A these may need to be rerouted to the south side of the street and raised and they will need to be supported over the excavation. Under Segment 9B they should not be impacted.

No further underground electrical equipment should be impacted by Segment 9A. However, under Segment 9B the following additional electrical equipment will be impacted: 1 large RC vault and two 6-conduit ductbanks at Howard Street; 1 medium RC vault and 3000' of active conduit in 1st Street; 1 medium and 1 small RC vault and 1800' of active conduit in Fremont Street; and, 1 large and 1 medium RC vault and 2400' of active conduit in Beale Street. Most of the impacted vaults will have to be reconstructed adjacent to the excavation. Much of the impacted conduit and duct banks can be supported in place over the excavation but some will need to be rerouted and/or raised to clear over the top of the underground station.

Communications:

Three small PacBell RC vaults and 5400' of conduit would be impacted by Segment 9B. The vaults would have to be reconstructed adjacent to the alignment and the conduit supported in place over the excavation with some relocated.

6.10 Segment 10

Location:

Segment 10 begins in Townsend Street just west of 3rd. It runs underground in Townsend Street similar to Segment 4 crossing beneath 3rd and 2nd. At 2nd Street it begins a 90° turn to the north and enters the Colin P. Kelly Jr. Street right-of-way halfway between Townsend and Brannan. It continues north under Colin P. Kelly, crosses beneath Brannan Street, and ends just south of Bryant Street where Segment 8 begins.

Proposed Construction:

Proposed construction will be cut-and-cover box tunnel for the entire length of Segment 10.

Existing Utility Impact:

The most significant utility impact will be along Townsend Street from 3rd to 2nd and in Brannan Street at Colin P. Kelly. The largest utilities impacted are a 3' X 5' brick sewer in Townsend, a 3' X 5' brick sewer crossing at 3rd, a 7.5' X 6' sewer crossing at Brannan, and a 5' saltwater intake tunnel in Townsend.

The Segment 10 alignment along Townsend is the same as Segment 4 until it leaves Townsend Street just past 2nd. Therefore, the breakdown of individual utility impacts will refer to Segment 4 for detailed discussions of the Townsend Street impacts. Segment 10 enters Colin P. Kelly Jr. Street about halfway between Townsend and Brannan, so utilities in Colin P. Kelly will only be impacted in the northern portion of the street.

Sewer:

Sewers impacted in Townsend Street are a 3' X 5' brick sewer running down the center of Townsend from 3rd to 2nd, a 21" sewer in Townsend from 2nd to 1st, a 3' X 5' brick sewer crossing Townsend at 3rd and an 8" VCP sewer crossing at 2nd. See Segment 4 - Sewer for discussions of the impacts. Segment 10 leaves Townsend just past 2nd, so the impact on the 21" sewer would only apply for a short distance. If the sewer down Townsend is relocated or supported on the north side of the excavation in Townsend, the 21" sewer will have to be supported in place across the Segment 10 excavation when it leaves Townsend and turns up to Colin P. Kelly.

An 18" VCP sewer runs down Colin P. Kelly from Brannan to Townsend. Segment 10 will enter Colin P. Kelly about halfway between Brannan and Townsend, so the

18" sewer from here on will have to be temporarily supported along the side of the cut-and-cover excavation. The east side would be preferred as Segment 10 enters Colin P. Kelly from the west side. Then the sewer would not have to be supported across the alignment. Service laterals from the west side of Colin P. Kelly would have to be supported across the excavation.

A 7.5' X 6' RC semi-circular gravity sewer and a 10" sludge force main cross the Segment 10 alignment in Brannan Street. The 10" force main is the same one which runs down Beale Street from Market to Bryant and runs down Townsend Street from 5th to 7th. Both sewers will need to be supported in place across the excavation. The 7.5' X 6' sewer will require a significant bridge structure to support it across the open excavation.

Several storm drain inlets will have to be replaced in Colin P. Kelly in addition to the inlets displaced in Townsend Street as discussed in Segment 4.

Potable Water:

An 8" water main runs down Townsend Street from 3rd to 1st and two 8" mains cross at 3rd and 2nd, see Segment 4 - Potable Water for a discussion of Townsend Street. It the 8" main in Townsend is supported along the north side of the excavation it will have to be supported across the excavation when Segment 10 turns up to Colin P. Kelly.

A 2" water line runs down the lower part of Colin P. Kelly Street to Townsend. Segment 10 may miss this line entirely. If not, it may be possible to cap this line where Segment 10 intersects it.

An 8" main crosses the alignment in Brannan Street and will have to be supported in place across the excavation.

Auxiliary (Fire) Water:

The segment 10 alignment curves toward Colin P. Kelly around the 2nd and Townsend saltwater intake pump station. See Segment 4 - Auxiliary Water for a discussion of this pump station and other auxiliary water impacts in Townsend Street. The Segment 10 alignment will have to pass under the 5' diameter intake tunnel when it leaves Townsend Street. The intake tunnel has an invert of approximately -21.2'. The current alignment profile here puts the top of the subway structure at about -16'. The profile would have to be lowered about 7 feet to clear below the intake tunnel and a temporary supporting structure. If the subway profile cannot be lowered sufficiently to clear below the intake tunnel, the intake tunnel can be raised. However, the tunnel supplies sea water to the pump station by gravity flow and the mean low water elevation of the bay is approximately -14' so the invert

of the intake tunnel can only be raised to approximately -19'. This would require lowering the alignment profile at least 5'.

A 16" auxiliary water line crosses the alignment in Brannan. This line will have to be supported in place over the excavation. No auxiliary water lines run in Colin P. Kelly.

Gas:

See Segment 4 - Gas for a discussion of the gas impacts on Townsend Street from 3rd through 2nd.

A 2" gas line runs up Colin P. Kelly which will have to be relocated along the west edge of Colin P. Kelly or supported along the side of the excavation.

A 6" gas line crosses the alignment in Brannan Street. It will have to be supported in place over the excavation.

Electrical:

PG&E has considerable underground electrical equipment in Townsend Street from 3rd to 2nd. The Segment 10 excavation will displace 2 large, 5 medium, and 5 small RC boxes and 2,200' of active conduit in Townsend Street. See Segment 4 - Electrical for further comments.

Two small RC boxes and 100' of active conduit will be impacted in Colin P. Kelly. These can probably be relocated in the west side of the street or temporarily strung along the side of the excavation.

Approximately 3 street lights will have to be replaced in Colin P. Kelly.

Communications:

Two medium and 7 small PacBell RC boxes and 3,000' of total conduit are displaced in Townsend Street by Segment 10. See Segment 4 - Communications for additional comments. In Colin P. Kelly, 3 small RC boxes and about 700' of total conduit will be displaced. These boxes and conduit will probably have to be supported on the sides of the excavation during construction.

6.11 Segment 11

Location:

Segment 11 begins in Townsend Street just west of 3rd. It extends beneath 3rd Street then begins a sweeping bend to the north, leaving Townsend just past 3rd, passing beneath Stanford, 2nd and Brannan streets and ending just before Bryant Street, due south of Essex Street.

Proposed Construction:

Segment 11 will be constructed as a cut-and-cover tunnel section across 3rd to the point where it leaves Townsend. From Townsend to Bryant it will be a mined tunnel.

Existing Utility Impact:

Segment 11 is very similar to Segment 2. All utility impacts will occur at the west end where Segment 11 crosses 3rd and Townsend. Refer to Segment 2 for the discussions of existing utility impacts there.

6.12 Segment 12

Location:

Segment 12 begins in King Street just west of 2nd. It continues down the north side of King Street to the Embarcadero where it turns north and follows the west side of the Embarcadero up to Townsend.

Proposed Construction:

Proposed construction will be cut-and-cover box tunnel for the entire length of Segment 12.

Existing Utility Impact:

The primary utility impacts in Segment 12 occur at each end, where it passes under 2nd Street and where it passes under Townsend and the Embarcadero. The two significant utilities affected are the 17.5' box sewer in King Street and the 5' diameter saltwater intake tunnel in Townsend Street.

Sewer:

The 17.5' box sewer in King Street will not be directly impacted by the alignment which stays to the north of it. But, as in Segment 6, special construction techniques may be required to support the box during cut-and-cover excavation.

An 8" VCP line crosses King Street at 2nd and will need to be supported in place during construction.

Two sewers cross the alignment in the Embarcadero at Townsend and will have to be supported in place during construction: a 24" ISP line with an invert of -7' coming east from Townsend and an 18" VCP line with an unknown invert coming south from Delancey Street (1st Street).

Approximately 14 storm drain inlets will be displaced over the length of Segment 12 and have to be replaced.

Potable Water:

An 8" water main crosses King Street at 2nd and will have to be supported in place over the excavation.

A 12" water main runs from Townsend Street north in the Embarcadero and will probably have to be supported longitudinally along the east wall of the excavation.

An 8" main from Townsend Street ties into the 12" line and will have to be supported across the excavation.

Auxiliary (Fire) Water:

The only auxiliary water system impact along Segment 12 is the 5' diameter RC saltwater intake tunnel which crosses the Embarcadero at Townsend. The intake tunnel invert at the Embarcadero is -21.3'. The top of the subway structure where it passes beneath the intake tunnel is approximately -17' (near the top of the intake tunnel). If the subway profile cannot be lowered sufficiently to clear below the intake tunnel, the intake tunnel can be raised. However, the tunnel supplies sea water to the pump station by gravity flow and the mean low water elevation of the bay is approximately -14' so the invert of the intake tunnel can only be raised to approximately -19'. This would require lowering the alignment profile at least 3'.

Gas:

Two gas lines cross the alignment in Segment 12, a 6" line crosses King Street at 2nd and a 4" line crosses the Embarcadero at Townsend. Both will have to be supported in place during construction.

Electrical:

No significant PG&E electrical equipment will be impacted by this segment. However, the Muni light rail extension along the Embarcadero and King Street has been completed in this area and there is likely to be DPW electrical equipment and conduit runs in the alignment route but specifics were not determined at the time of this report.

Approximately 14 street lights and 8 traffic signals will have to be replaced due to the Segment 12 excavation.

Communications:

No known communications equipment is impacted by Segment 12.

APPENDIX A

Summary of Utility Impacts by Segment

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 1A

Prepared by AGS, Inc.
11/7/95

SEGMENT 1A: 7th St., Townsend St.

7th to 6th: surface
6th thru 5th: U-wall
5th to 3rd: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	15" VCP	leave in place	7th to 4th	2300
	2.	3' X 5' brick	leave in place	4th to 3rd	900
	3.	10" force main	relocate	7th to 5th	1500
	4.	4 - 9.5' X 8.3' RC boxes	leave in place	xing @ 7th/Berry	80
	5.	10' X 7' RC on piles	leave in place	xing @ 6th	80
	6.	6' ϕ RC on piles*	consolidate w/ 9' X 7'	xing @ 6th	700
	7.	9' X 7' RC on piles*	reroute to 6th	xing @ 5th	1000
	8.	18" pipe	abandon	xing @ 5th	500
	9.	6.5' ϕ brick/concrete	support in place	xing @ 4th	1
	10.	30" force main	support in place	xing @ 4th	80
	11.	21" pipe	support in place	xing @ 4th	20
	12.	Service laterals	support in place	3 between 7th/3rd	150
	13.	Storm drain inlets	replace	7th to 3rd	12

*Consolidate 6th and 5th St. sewers in new sewer routed down Townsend and 6th to Berry

Potable Water	1.	8" pipe	leave in place	7th to 3rd	3200
	2.	12" pipe	support in place	xing @ 4th	40
	3.	8" pipe	reroute around U-wall	xing @ 5th	600
	4.	Service laterals	support in place	3 between 7th/3rd	150

Auxiliary Water	1.	12" pipe	reinforce in place	xing @ 6th	50
	2.	12" pipe	reroute around U-wall	xing @ 5th	600
	3.	12" pipe	support in place	xing @ 4th	40

Gas	1.	16" CI pipe	relocate - north	4th to 3rd	900
	2.	3" PL pipe	support in place	xing @ 4th	40
	3.	1" PL pipe - laterals	support in place	2 between 5th/4th	80

Electrical	1.	Medium RC box	replace		1
	2.	Large RC box	replace		1
	3.	Active conduit (3"/6")	relocate	7th to 3rd	1145
	4.	Trench, joint (18"X40")	relocate	7th to 3rd	1145
	5.	Overhead power poles	relocate	7th to 3rd	9
	6.	Streetlights/signals	replace	7th to 3rd	12

Communications	1.	Small RC box (PacBell)	replace		4
	2.	Conduit (2"/4") (PacBell)	relocate	5th to 3rd	3800

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 1B

Prepared by AGS, Inc.
11/7/95

SEGMENT 1B: 7th St., Townsend St.

7th - to Irwin: surface
7th - Irwin to Berry: U-wall
Berry to 3rd: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	15" VCP	leave in place	7th to 4th	2300
	2.	3' X 5' brick	leave in place	4th to 3rd	900
	3.	10" force main	relocate	7th to 5th	1500
	4.	4 - 9.5' X 8.3' RC boxes	lower	xing @ 7th/Berry	1
	5.	10' X 7' RC on piles	support in place	xing @ 6th	1
	6.	6' ϕ RC on piles	support in place	xing @ 6th	1
	7.	9' X 7' RC on piles	support in place	xing @ 5th	1
	8.	18" pipe	support in place	xing @ 5th	40
	9.	6.5' ϕ brick/concrete	support in place	xing @ 4th	1
	10.	30" force main	support in place	xing @ 4th	40
	11.	21" pipe	support in place	xing @ 4th	40
	12.	Service laterals	support in place	3 between 7th/3rd	150
	13.	Storm drain inlets	replace	7th to 3rd	18
Potable Water	1.	8" pipe	leave in place	7th to 3rd	3200
	2.	18" stl. pipe	reroute around U-wall	xing @ Berry	200
	3.	12" pipe	support in place	xing @ 4th	40
	4.	8" pipe	support in place	xing @ 5th	40
	5.	Service laterals	support in place	3 between 7th/3rd	150
Auxiliary Water	1.	14" CI pipe	reroute around U-wall	xing @ Berry	200
	2.	12" CI pipe	support in place	3: xing @ 6th, 5th, 4th	120
Gas	1.	16" CI pipe	relocate - north	4th to 3rd	900
	2.	3" PL pipe	support in place	xing @ 4th	40
	3.	1" PL pipe - laterals	support in place	2 between 5th/4th	80
Electrical	1.	Medium RC box	replace		1
	2.	Large RC box	replace		1
	3.	Active conduit (3"/6")	relocate	7th to 3rd	1145
	4.	Trench, joint (18"X40")	relocate	7th to 3rd	1145
	5.	Overhead power poles	relocate	7th to 3rd	9
	6.	Streetlights/signals	replace	7th to 3rd	20
Communications	1.	Small RC box (PacBell)	replace		4
	2.	Conduit (2"/4") (PacBell)	relocate	5th to 3rd	3800

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 2

Prepared by AGS, Inc
11/7/95

SEGMENT 2: Begin Townsend St., End Bryant St. (link segments 1 and 3) 3rd to Bryant: mined tunnel

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' X 5' brick	relocate	2: xing @ 3rd	250
	2.	Transition structures	new	for 3'X5' brick (2)	4
	3.	Storm drain inlets	replace	@ 3rd	3
Potable Water	1.	6"/8" pipe	support in place	2: xing @ 3rd	200
Auxiliary Water	1.	12" pipe	support in place	xing @ 3rd	150
	2.	8" lateral to hydrant	extend/support	xing @ 3rd	50
Gas	1.	4"/6" CI pipe	support in place	2: xing @ 3rd	200
	2.	10" CI pipe	extend/support	xing @ 3rd	50
Electrical	1.	Medium RC box	replace		2
	2.	Active conduit (3"/6")	relocate	3rd	1900
	3.	Trench (18"X40")	relocate	3rd	100
	4.	Streetlights/signals	replace	3rd	4
Communications	1.	Small RC box (PacBell)	replace		1
	2.	Medium RC box (PacBell)	replace		1
	3.	Conduit (2"/4") (PacBell)	relocate	3rd	800
	4.	Trench (18"X40")	relocate	3rd	100

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 3AC

Prepared by AGS, Inc.
11/7/95

SEGMENT 3AC: Beale St.(from segment 5)

Bryant to Howard: cut/cover, subway
Howard to Market: cut/cover, 3-level station

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	12"/18" ISP/VCP	relocate	Bryant to Market	3000
	2.	10" force main	relocate	Bryant to Market	3000
	3.	24" ISP	support in place	xing @ Bryant	80
	4.	12" VCP	support in place	xing @ Harrison	80
	5.	3' X 5' brick	replace/support	xing @ Folsom	100
	6.	3' X 5' brick*	consolidate w/ 3.5'X5.3'	xing @ Howard	700
	7.	3.5' X 5.3' concrete*	reroute down Howard	xing @ Mission	1300
	8.	Service laterals	replace		22
	9.	Transition structures	new	for 3'X5' brick	3
	10.	Storm drain inlets	replace	Bryant to Market	31
		*Consolidate Mission and Howard St. sewers in new sewer routed down Fremont and Howard to Main.			
Potable Water	1.	12" pipe	relocate	Bryant to Market	3000
	2.	8"/12" pipe	support in place	5: xing between Bryant/Market	400
	3.	20" pipe	support in place	xing @ Folsom	80
	4.	Service laterals	replace		22
Auxiliary Water	1.	10"/16" CI pipe	relocate - west	Bryant to Market	3000
	2.	12" CI pipe	support in place	3: xing @ Folsom, Howard, Mission	160
	3.	8" lateral to hydrants	relocate	4 between Bryant/Mission	4
	4.	35' ϕ X 24' cistern	replace	Beale @ Howard	1
Gas	1.	4" PL pipe	relocate	Bryant to Folsom	1200
	2.	16" CI pipe	relocate - west	Folsom to Market	1800
	3.	3" PL pipe	relocate	xing @ Howard	80
	4.	8" CI pipe	relocate	xing @ Mission	80
	5.	1" PL pipe - laterals	relocate	3 between Bryant/Howard	240
Electrical	1.	Small RC box	replace		11
	2.	Medium RC box	replace		8
	3.	Large RC box	replace		17
	4.	Active conduit (3"/6")	relocate	Bryant to Market	22500
	5.	Trench (18"X40")	relocate	Bryant to Market	3400
	6.	Streetlights/signals	replace	Bryant to Market	40
Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		9
	3.	Large RC box (PacBell)	replace		1
	4.	Conduit (2"/4") (PacBell)	relocate	Harrison to Market	29100
	5.	Trench (18"X40")	relocate	Harrison to Market	2500

Caltrain SF Downtown Station EIS/EIR
Screening Estimate - Utilities
Segment 3BC

Prepared by AGS, Inc.
11/7/95

SEGMENT 3BC: Beale St.(from segment 5)

Bryant to Folsom: cut/cover, subway
Folsom to Market: cut/cover, 2-level staggered statio

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	12"/18" ISP/VCP	relocate	Bryant to Market	3000
	2.	10" force main	relocate	Bryant to Market	3000
	3.	24" ISP	support in place	xing @ Bryant	80
	4.	12" VCP	support in place	xing @ Harrison	80
	5.	3' X 5' brick	replace/support	xing @ Folsom	100
	6.	3' X 5' brick	replace/support	xing @ Howard	100
	7.	3.5' X 5.3' concrete	support in place	xing @ Mission	80
	8.	Service laterals	replace		22
	9.	Transition structures	new	for 3'X5' brick (2)	4
	10.	Storm drain inlets	replace	Bryant to Market	31
Potable Water	1.	12" pipe	relocate	Bryant to Market	3000
	2.	8"/12" pipe	support in place	5: xing between Bryant/Market	400
	3.	20" pipe	support in place	xing @ Folsom	80
	4.	Service laterals	replace		22
Auxiliary Water	1.	10"/16" CI pipe	relocate - west	Bryant to Market	3000
	2.	12" CI pipe	support in place	3: xing @ Folsom, Howard, Mission	160
	3.	8" lateral to hydrants	relocate	4 between Bryant/Mission	4
	4.	35' ϕ X 24' cistern	replace	Beale @ Howard	1
Gas	1.	4" PL pipe	relocate	Bryant to Folsom	1200
	2.	16" CI pipe	relocate - west	Folsom to Market	1800
	3.	3" PL pipe	relocate	xing @ Howard	80
	4.	8" CI pipe	relocate	xing @ Mission	80
	5.	1" PL pipe - laterals	relocate	3 between Bryant/Howard	240
Electrical	1.	Small RC box	replace		11
	2.	Medium RC box	replace		8
	3.	Large RC box	replace		17
	4.	Active conduit (3"/6")	relocate	Bryant to Market	22500
	5.	Trench (18"X40")	relocate	Bryant to Market	3400
	6.	Streetlights/signals	replace	Bryant to Market	40
Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		9
	3.	Large RC box (PacBell)	replace		1
	4.	Conduit (2"/4") (PacBell)	relocate	Harrison to Market	29100
	5.	Trench (18"X40")	relocate	Harrison to Market	2500

Caltrain SF Downtown Station EIS/EIR
Screening Estimate - Utilities
Segment 3CC

Prepared by AGS, Inc.
11/7/95

SEGMENT 3CC: Beale St.(from segment 5)

Bryant to Folsom: cut/cover, subway
Folsom to Mission: cut/cover, 2-level station

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	12"/18" ISP/VCP	relocate	Bryant to Market	3000
	2.	10" force main	relocate	Bryant to Market	3000
	3.	24" ISP	support in place	xing @ Bryant	80
	4.	12" VCP	support in place	xing @ Harrison	80
	5.	3' X 5' brick	replace/support	xing @ Folsom	100
	6.	3' X 5' brick	replace/support	xing @ Howard	100
	7.	3.5' X 5.3' concrete	support in place	xing @ Mission	80
	8.	Service laterals	replace		22
	9.	Transition structures	new	for 3'X5' brick (2)	4
	10.	Storm drain inlets	replace	Bryant to Market	25
Potable Water	1.	12" pipe	relocate	Bryant to Market	3000
	2.	8"/12" pipe	support in place	5: xing between Bryant/Market	400
	3.	20" pipe	support in place	xing @ Folsom	80
	4.	Service laterals	replace		22
Auxiliary Water	1.	10"/16" CI pipe	relocate - west	Bryant to Market	3000
	2.	12" CI pipe	support in place	3: xing @ Folsom, Howard, Mission	160
	3.	8" lateral to hydrants	relocate	4 between Bryant/Mission	4
	4.	35' ϕ X 24' cistern	replace	Beale @ Howard	1
Gas	1.	4" PL pipe	relocate	Bryant to Folsom	1200
	2.	16" CI pipe	relocate - west	Folsom to Market	1800
	3.	3" PL pipe	relocate	xing @ Howard	80
	4.	8" CI pipe	relocate	xing @ Mission	80
	5.	1" PL pipe - laterals	relocate	3 between Bryant/Howard	240
Electrical	1.	Small RC box	replace		11
	2.	Medium RC box	replace		8
	3.	Large RC box	replace		12
	4.	Active conduit (3"/6")	relocate	Bryant to Market	22500
	5.	Trench (18"X40")	relocate	Bryant to Market	3400
	6.	Streetlights/signals	replace	Bryant to Market	34
Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		9
	3.	Large RC box (PacBell)	replace		1
	4.	Conduit (2"/4") (PacBell)	relocate	Harrison to Market	29100
	5.	Trench (18"X40")	relocate	Harrison to Market	2500

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 3AM

Prepared by AGS, Inc.
11/7/95

SEGMENT 3AM: Beale St.(from segment 2)

Bryant to Harrison: mined tunnel
Harrison to Market: cut/cover, 3-level station

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	12"/15" ISP/VCP	relocate	Harrison to Market	2300
	2.	10" force main	relocate	Harrison to Market	2300
	3.	12" VCP	leave in place	xing @ Harrison	80
	4.	3' X 5' brick	replace/support	xing @ Folsom	100
	5.	3' X 5' brick*	consolidate w/ 3.5'X5.3'	xing @ Howard	700
	6.	3.5' X 5.3' concrete*	reroute down Howard	xing @ Mission	1300
	7.	Service laterals	replace		18
	8.	Transition structures	new	for 3'X5' brick	3
	9.	Storm drain inlets	replace	Harrison to Market	26

*Consolidate Mission and Howard St. sewers in new sewer routed down Fremont and Howard to Main.

Potable Water	1.	12" pipe	relocate	Harrison to Market	2300
	2.	8"/12" pipe	support in place	3: xing between Harrison/Market	240
	3.	20" pipe	support in place	xing @ Folsom	80
	4.	Service laterals	replace		18

Auxiliary Water	1.	10"/14" CI pipe	relocate - west	Harrison to Market	2300
	2.	12" CI pipe	support in place	3: xing @ Folsom, Howard, Mission	160
	3.	8" lateral to hydrants	relocate	2 between Howard/Mission	2
	4.	35' ϕ X 24' cistern	replace	Beale @ Howard	1

Gas	1.	4" PL pipe	relocate	Harrison to Folsom	500
	2.	16" CI pipe	relocate - west	Folsom to Market	1800
	3.	3" PL pipe	relocate	xing @ Howard	80
	4.	8" CI pipe	relocate	xing @ Mission	80
	5.	1" PL pipe - laterals	relocate	2 between Folsom/Howard	160

Electrical	1.	Small RC box	replace		9
	2.	Medium RC box	replace		6
	3.	Large RC box	replace		17
	4.	Active conduit (3"/6")	relocate	Harrison to Market	21600
	5.	Trench (18"X40")	relocate	Harrison to Market	2600
	6.	Streetlights/signals	replace	Harrison to Market	34

Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		9
	3.	Large RC box (PacBell)	replace		1
	4.	Conduit (2"/4") (PacBell)	relocate	Harrison to Market	29100
	5.	Trench (18"X40")	relocate	Harrison to Market	2500

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 3BM

Prepared by AGS, Inc.
11/7/95

SEGMENT 3BM: Beale St.(from segment 2)

Bryant to Harrison: mined tunnel
Harrison to Market: cut/cover, 2-level staggered stati

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	12"/15" ISP/VCP	relocate	Harrison to Market	2300
	2.	10" force main	relocate	Harrison to Market	2300
	3.	12" VCP	leave in place	xing @ Harrison	80
	4.	3' X 5' brick	replace/support	xing @ Folsom	100
	5.	3' X 5' brick	replace/support	xing @ Howard	100
	6.	3.5' X 5.3' concrete	support in place	xing @ Mission	80
	7.	Service laterals	replace		18
	8.	Transition structures	new	for 3'X5' brick (2)	4
	9.	Storm drain inlets	replace	Harrison to Market	26
Potable Water	1.	12" pipe	relocate	Harrison to Market	2300
	2.	8"/12" pipe	support in place	3: xing between Harrison/Market	240
	3.	20" pipe	support in place	xing @ Folsom	80
	4.	Service laterals	replace		18
Auxiliary Water	1.	10"/14" CI pipe	relocate - west	Harrison to Market	2300
	2.	12" CI pipe	support in place	3: xing @ Folsom, Howard, Mission	160
	3.	8" lateral to hydrants	relocate	2 between Howard/Mission	2
	4.	35' ϕ X 24' cistern	replace	Beale @ Howard	1
Gas	1.	4" PL pipe	relocate	Harrison to Folsom	500
	2.	16" CI pipe	relocate - west	Folsom to Market	1800
	3.	3" PL pipe	relocate	xing @ Howard	80
	4.	8" CI pipe	relocate	xing @ Mission	80
	5.	1" PL pipe - laterals	relocate	2 between Folsom/Howard	160
Electrical	1.	Small RC box	replace		9
	2.	Medium RC box	replace		6
	3.	Large RC box	replace		17
	4.	Active conduit (3"/6")	relocate	Harrison to Market	21600
	5.	Trench (18"X40")	relocate	Harrison to Market	2600
	6.	Streetlights/signals	replace	Harrison to Market	34
Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		9
	3.	Large RC box (PacBell)	replace		1
	4.	Conduit (2"/4") (PacBell)	relocate	Harrison to Market	29100
	5.	Trench (18"X40")	relocate	Harrison to Market	2500

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 3CM

Prepared by AGS, Inc.
11/7/95

SEGMENT 3CM: Beale St.(from segment 2)

Bryant to Harrison: mined tunnel
Harrison to Mission: cut/cover, 2-level station

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	12"/15" ISP/VCP	relocate	Harrison to Market	2300
	2.	10" force main	relocate	Harrison to Market	2300
	3.	12" VCP	leave in place	xing @ Harrison	80
	4.	3' X 5' brick	replace/support	xing @ Folsom	100
	5.	3' X 5' brick	replace/support	xing @ Howard	100
	6.	3.5' X 5.3' concrete	support in place	xing @ Mission	80
	7.	Service laterals	replace		18
	8.	Transition structures	new	for 3'X5' brick (2)	4
	9.	Storm drain inlets	replace	Harrison to Market	20
Potable Water	1.	12" pipe	relocate	Harrison to Market	2300
	2.	8"/12" pipe	support in place	3: xing between Harrison/Market	240
	3.	20" pipe	support in place	xing @ Folsom	80
	4.	Service laterals	replace		18
Auxiliary Water	1.	10"/14" CI pipe	relocate - west	Harrison to Market	2300
	2.	12" CI pipe	support in place	3: xing @ Folsom, Howard, Mission	160
	3.	8" lateral to hydrants	relocate	2 between Howard/Mission	2
	4.	35' ϕ X 24' cistern	replace	Beale @ Howard	1
Gas	1.	4" PL pipe	relocate	Harrison to Folsom	500
	2.	16" CI pipe	relocate - west	Folsom to Market	1800
	3.	3" PL pipe	relocate	xing @ Howard	80
	4.	8" CI pipe	relocate	xing @ Mission	80
	5.	1" PL pipe - laterals	relocate	2 between Folsom/Howard	160
Electrical	1.	Small RC box	replace		9
	2.	Medium RC box	replace		6
	3.	Large RC box	replace		12
	4.	Active conduit (3"/6")	relocate	Harrison to Market	21600
	5.	Trench (18"X40")	relocate	Harrison to Market	2600
	6.	Streetlights/signals	replace	Harrison to Market	28
Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		9
	3.	Large RC box (PacBell)	replace		1
	4	Conduit (2"/4") (PacBell)	relocate	Harrison to Market	29100
	5.	Trench (18"X40")	relocate	Harrison to Market	2500

Caltrain SF Downtown Station EIS/EIR
Screening Estimate - Utilities
Segment 4

Prepared by AGS, Inc.
11/7/95

SEGMENT 4: Townsend St.

3rd to Embarcadero: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' x 5' brick	relocate - north	3rd to 2nd	800
	2.	21"/24" ISP	relocate - north	2nd to 1st	900
	3.	8" VCP	support in place	xing @ 2nd	40
	4.	18"/24" VCP	support in place	2: xing @ 1st	80
	5.	3' X 5' brick	replace/support	xing @ 3rd	50
	6.	Service laterals	replace		28
	7.	Transition structures	new	for 3'X5' brick (2)	4
	8.	Storm drain inlets	replace	3rd to Embarcadero	16
Potable Water	1.	8" pipe	leave in place	3rd to 1st	1800
	2.	8" pipe	support in place	3: xing at 3rd, 2nd, 1st	120
	3.	Service laterals	support in place	10 @ 50' each	500
Auxiliary Water	1.	12"/20" CI pipe	relocate	3rd to 2nd	700
	2.	5' ϕ concrete	leave in place	2nd to 1st	800
	3.	12" CI pipe	support in place	xing @ 2nd	40
	4.	5' ϕ concrete	lower	xing @ 1st	100
	5.	8" laterals to hydrants	support in place	2 between 3rd/2nd	80
Gas	1.	6" CI pipe	leave in place	3rd to 2nd	900
	2.	4" CI pipe	relocate	2nd to 1st	900
	3.	4" CI pipe	support in place	2: xing @ 3rd, Embarcadero	80
	4.	10" CI pipe	extend/support	xing @ 3rd	40
	5.	6" CI pipe	support in place	2: xing @ 2nd, Embarcadero	80
	6.	1" PL pipe laterals	support in place	8 between 3rd/1st	320
Electrical	1.	Small RC box	replace		7
	2.	Medium RC box	replace		5
	3.	Large RC box	replace		2
	4.	Active conduit (3"/6")	relocate	3rd to 1st	2870
	5.	Trench (18"X40")	relocate	3rd to 1st	1670
	6.	Streetlights/signals	replace	3rd to 1st	20
Communications	1.	Small RC box (PacBell)	replace		9
	2.	Medium RC box (PacBell)	replace		2
	3.	Conduit (2"/4") (PacBell)	relocate	3rd to 1st	3600
	4.	Trench (18"X40")	relocate	3rd to 1st	1600

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 5

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SEGMENT 5: Embarcadero, Beale St.

Townsend to Bryant: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	2.5' x 3.8' RC	leave in place	Brannan to Bryant	600
	2.	7.5' X 6' RC	leave in place	xing @ Brannan	50
	3.	2.5' X 3.8' RC	leave in place	xing @ Brannan	50
Potable Water	1.	12" pipe	relocate	Townsend to Brannan	1100
Auxiliary Water					
Gas					
Electrical	1.	Streetlights/signals	replace	Townsend to Brannan	6
Communications					

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 6A

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SEGMENT 6A: 7th St., King St.

7th to Berry: surface
Berry to 6th: U-wall
6th to 2nd: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	4 - 9.5' X 8.3' RC boxes	leave in place	xing @ 7th/Berry	40
	2.	10' X 7' RC on piles*	reroute to 7th/Berry	xing @ 6th	2000
	3.	6' ϕ RC on piles*	consolidate w/ 10' X 7'	xing @ 6th	0
	4.	9' X 7' RC on piles*	reroute to 6th	xing @ 5th	1000
	5.	23' X 2' RC box	support in place	xing @ 5th	60
	6.	18" pipe*	empty into 9' X 7'	xing @ 5th	20
	7.	6.5' ϕ brick/concrete*	reroute to 5th	xing @ 4th	1000
	8.	30" force main	relocate around station	xing @ 4th	100
	9.	21" pipe*	empty into 6.5'	xing @ 4th	20
	10.	3' X 5' brick	replace/support	xing @ 3rd	50
	11.	15" VCP	relocate	3rd to 2nd	500
	12.	Service laterals	replace		9
	13.	Transition structures	new	for 3'X5' brick	2
	14.	Storm drain inlets	replace	6th to 2nd	16

*Consolidate 6th, 5th, and 4th St. sewers in new sewer routed down Townsend and 7th to Berry

Potable Water	1.	8" pipe	relocate	3rd to 2nd	900
	2.	18" stl. pipe	leave in place	xing @ Berry	40
	3.	8"/12" pipe	relocate around station	2: xing @ 5th, 4th	200
	4.	8" pipe	support in place	xing @ 3rd	50
	5.	Service laterals	replace		9

Auxiliary Water	1.	14" CI pipe	leave in place	xing @ Berry	100
	2.	12" CI pipe	support in place	3: xing @ 6th, 5th, 4th	180

Gas	1.	2" PL pipe	relocate	3rd to 2nd	500
	2.	3"/4" pipe	support in place	2: xing @ 4th, 3rd	100
	3.	10" pipe	support in place	xing @ 3rd	40

Electrical	1.	Small RC box	replace		4
	2.	Medium RC box	replace		1
	3.	Active conduit (3"/6")	relocate	3rd to 2nd	2600
	4.	Trench, joint (18"X40")	relocate	3rd to 2nd	1000
	5.	Streetlights/signals	replace	7rd to 2nd	28

Communications	1.	Small RC box (PacBell)	replace		5
	2.	Conduit (2"/4") (PacBell)	relocate	3rd to 2nd	800

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Screening Estimate - Utilities

Segment 6B

Prepared by AGS, Inc.
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SEGMENT 6B: 7th St., King St.

7th - to Irwin: surface
7th - Irwin to Berry: U-wall
Berry to 2nd: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	4 - 9.5' X 8.3' RC boxes	lower	xing @ 7th/Berry	1
	2.	10' X 7' RC on piles*	reroute to 7th/Berry	xing @ 6th	2000
	3.	6' ϕ RC on piles*	consolidate w/ 10' X 7'	xing @ 6th	0
	4.	9' X 7' RC on piles*	reroute to 6th	xing @ 5th	1000
	5.	23' X 2' RC box	support in place	xing @ 5th	60
	6.	18" pipe*	empty into 9' X 7'	xing @ 5th	20
	7.	6.5' ϕ brick/concrete*	reroute to 5th	xing @ 4th	1000
	8.	30" force main	relocate around station	xing @ 4th	100
	9.	21" pipe*	empty into 6.5'	xing @ 4th	20
	10.	3' X 5' brick	replace/support	xing @ 3rd	50
	11.	15" VCP	relocate	3rd to 2nd	500
	12.	Service laterals	replace		9
	13.	Transition structures	new	for 3'X5' brick	2
	14.	Storm drain inlets	replace	6th to 2nd	18

*Consolidate 6th, 5th, and 4th St. sewers in new sewer routed down Townsend and 7th to Berry

Potable Water	1.	8" pipe	relocate	3rd to 2nd	900
	2.	18" stl. pipe	reroute around U-wall	xing @ Berry	200
	3.	8"/12" pipe	relocate around station	2: xing @ 5th, 4th	200
	4.	8" pipe	support in place	xing @ 3rd	50
	5.	Service laterals	replace		9

Auxiliary Water	1.	14" CI pipe	reroute around U-wall	xing @ Berry	200
	2.	12" CI pipe	support in place	3: xing @ 6th, 5th, 4th	180

Gas	1.	2" PL pipe	relocate	3rd to 2nd	500
	2.	3"/4" pipe	support in place	2: xing @ 4th, 3rd	100
	3.	10" pipe	support in place	xing @ 3rd	40

Electrical	1.	Small RC box	replace		4
	2.	Medium RC box	replace		1
	3.	Active conduit (3"/6")	relocate	3rd to 2nd	2600
	4.	Trench, joint (18"X40")	relocate	3rd to 2nd	1000
	5.	Streetlights/signals	replace	7rd to 2nd	30

Communications	1.	Small RC box (PacBell)	replace		5
	2.	Conduit (2"/4") (PacBell)	relocate	3rd to 2nd	800

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Segment 7

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SEGMENT 7: King St., Colin P. Kelly St. 2nd to Bryant: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	18" VCP	relocate	Townsend to Brannan	550
	2.	8" VCP	support in place	xing @ 2nd	50
	3.	24" VCP	support in place	xing @ Townsend	50
	4.	7.5' X 6' RC	support in place	xing @ Brannan	50
	5.	10" force main	support in place	xing @ Brannan	50
	6.	Service laterals	replace		6
	7.	Storm drain inlets	replace	2nd to Brannan	6
Potable Water	1.	2" pipe	relocate	Townsend to Brannan	550
	2.	8" pipe	support in place	3: xing @ 2nd, Townsend, Brannan	150
	3.	Service laterals	replace		6
Auxiliary Water	1.	5' ϕ concrete	lower	xing @ Townsend	100
	2.	16" CI pipe	support in place	xing @ Brannan	50
Gas	1.	2" PL pipe	relocate	Townsend to Brannan	550
	2.	4"/6" pipe	support in place	3: xing @ 2nd, Townsend, Brannan	150
Electrical	1.	Small RC box	replace		2
	2.	Active conduit (3"/6")	relocate	2nd, Colin P. Kelly	275
	3.	Streetlights/signals	replace	2nd, Colin P. Kelly	8
Communications	1.	Small RC box (Pac Bell)	replace		4
	2.	Conduit (2"/4") (PacBell)	relocate	2nd, Colin P. Kelly	1025
	3.	Trench, joint (18"X40")	relocate	2nd, Colin P. Kelly	1000

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Screening Estimate - Utilities

Segment 8

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SEGMENT 8: Between 1st and 2nd, under Essex

Bryant to Folsom: tunnel

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' X 5' brick	leave in place	xing @ Bryant	50
Potable Water					
Auxiliary Water					
Gas					
Electrical	1.	230 kV tar-enamel line	leave in place	xing @ Harrison	50
Communications					

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 9A

Prepared by AGS, Inc.
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SEGMENT 9A: Between 1st and 2nd, then to Beale St.

Folsom to Beale: aerial

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' X 5' brick	replace/reroute	xing @ Folsom	80
Potable Water	1.	20" pipe	raise/support in place	xing @ Folsom	80
	2.	6" pipe	raise/support in place	xing @ Folsom	80
Auxiliary Water	1.	12" pipe	raise/support in place	xing @ Folsom	80
Gas	1.	16" CI pipe	raise/support in place	xing @ Folsom	80
	2.	6" CI pipe	raise/support in place	xing @ Folsom	80
Electrical	1.	230 kV tar-enamel line	support in place	xing @ Folsom	80
	2.	RC boxes	relocate	@ Folsom	0
	3.	Active conduit (3"/6")	support in place	xing @ Folsom (2 duct banks)	2
Communications	1.	RC boxes	relocate	@ Folsom	0
	2.	Conduit (2"/4")	support in place	xing @ Folsom (1 duct bank)	1

Aerial structure column locations not yet defined. Allowance for utility relocation due to colu

Caltrain SF Downtown Station EIS/EIR

Screening Estimate - Utilities

Segment 9B

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SEGMENT 9B: Between 1st and 2nd, then to Beale St.

Folsom to Beale: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' X 5' brick	replace/reroute/support	6: xing @ Folsom, Clementina, Tehama, Howard, Natoma, 1st	480
	2.	12" VCP	support in place	2: xing @ Fremont, Beale	160
	3.	10" force main	support in place	xing @ Beale	80
Potable Water	1.	20" pipe	support in place	xing @ Folsom	80
	2.	12" pipe	support in place	xing @ Beale	80
	3.	8" pipe	support in place	3: xing @ Howard, 1st, Fremont	240
	4.	4"/6" pipe	support in place	4: @ Folsom, Clementina, Tehama, Natoma	320
Auxiliary Water	1.	12" pipe	leave in place	xing @ Folsom	80
	2.	10"/12" pipe	support in place	3: xing @ Howard, 1st, Beale	240
Gas	1.	16" CI pipe	support in place	2: xing @ Folsom, Beale	160
	2.	6" CI pipe	support in place	xing @ Folsom	80
	3.	2"/4" PL pipe	support in place	8: xing @ Clementina, Tehama, Howard, 1st, Fremont	640
Electrical	1.	230 kV tar-enamel line	support in place	xing @ Folsom	80
	2.	Small RC box	replace		1
	3.	Medium RC box	replace		3
	4.	Large RC box	replace		2
	5.	Active conduit (3"/6")	support in place	xing between Folsom/Beale	8000
Communications	1.	Small RC boxes	replace		3
	2.	Conduit (2"/4")	support in place	xing between Folsom/Beale	5400

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Screening Estimate - Utilities
Segment 10

Prepared by AGS, Inc.
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SEGMENT 10: Townsend St., Colin P. Kelly St. 3rd to Bryant: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' X 5' brick	relocate - west	3rd to 2nd	800
	2.	18" VCP	relocate	Townsend to Brannan	350
	3.	3' X 5' brick	replace/support	xing @ 3rd	50
	4.	8" VCP	support in place	xing @ 2nd	40
	5.	21" VCP	extend/support	xing @ 2nd	60
	6.	7.5' X 6' RC	support in place	xing @ Brannan	50
	7.	10" force main	support in place	xing @ Brannan	50
	8.	Service laterals	replace		19
	9.	Transition structures	new	3'X5' brick (2)	4
	10.	Storm drain inlets	replace	3rd to Brannan	6
Potable Water	1.	8" pipe	leave in place	3rd to 2nd	900
	2.	2" pipe	relocate	Townsend to Brannan	350
	3.	8" pipe	support in place	4: xing @ 3rd, 2nd, Brannan	230
	4.	Service laterals	support in place	9 @ 50' each	450
Auxiliary Water	1.	12"/20" CI pipe	relocate	3rd to 2nd	700
	2.	5' ϕ RC	lower	xing @ 2nd	100
	3.	12" CI pipe	support in place	xing @ 2nd	50
	4.	16" CI pipe	support in place	xing @ Brannan	50
	5.	8" laterals to hydrants	support in place	2 between 3rd/2nd	80
Gas	1.	6" CI pipe	leave in place	3rd to 2nd	900
	2.	2" PL pipe	relocate	Townsend to Brannan	350
	3.	4"/6" CI pipe	support in place	4: xing @ 3rd, 2nd, Brannan	230
	4.	10" CI pipe	extend/support	xing @ 3rd	40
	5.	1" PL pipe-laterals	support in place	7 between 3rd/2nd	280
Electrical	1.	Small RC box	replace		7
	2.	Medium RC box	replace		5
	3.	Large RC box	replace		2
	4.	Active conduit (3"/6")	relocate	3rd to 2nd, Colin P. Kelly	2300
	5.	Trench (18"X40")	relocate	3rd to 2nd, Colin P. Kelly	1100
	6.	Streetlights/signals	replace	3rd to 2nd, Colin P. Kelly	12
Communications	1.	Small RC box (PacBell)	replace		10
	2.	Medium RC box (PacBell)	replace		2
	3.	Conduit (2"/4") (PacBell)	relocate	3rd to 2nd, Colin P. Kelly	3725
	4.	Trench (18"X40")	relocate	3rd to 2nd, Colin P. Kelly	1300

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Screening Estimate - Utilities

Segment 11

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SEGMENT 11: Begin Townsend St., End Bryant St. (link segments 1 and 8) 3rd to Bryant: mined tunnel

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	3' X 5' brick	relocate	2: xing @ 3rd	250
	2.	Transition structures	new	for 3'X5' brick (2)	4
	3.	Storm drain inlets	replace	@ 3rd	3
Potable Water	1.	6"/8" pipe	support in place	2: xing @ 3rd	200
Auxiliary Water	1.	12" pipe	support in place	xing @ 3rd	150
	2.	8" lateral to hydrant	extend/support	xing @ 3rd	50
Gas	1.	4"/6" CI pipe	support in place	2: xing @ 3rd	200
	2.	10" CI pipe	extend/support	xing @ 3rd	50
Electrical	1.	Medium RC box	replace		2
	2.	Active conduit (3"/6")	relocate	3rd	1900
	3.	Trench (18"X40")	relocate	3rd	100
	4.	Streetlights/signals	replace	3rd	4
Communications	1.	Small RC box (PacBell)	replace		1
	2.	Medium RC box (PacBell)	replace		1
	3.	Conduit (2"/4") (PacBell)	relocate	3rd	800
	4.	Trench (18"X40")	relocate	3rd	100

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Screening Estimate - Utilities

Segment 12

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SEGMENT 12: King St., Embarcadero

2nd to 1st: cut/cover

UTILITY	NO.	ITEM	DISPOSITION	LIMITS	QUANTITY
Sewer	1.	17.5' wide RC box	leave in place	2nd to Embarcadero	650
	2.	8" VCP	support in place	xing @ 2nd	50
	3.	18"/24"	support in place	2: xing @ Townsend	100
	4.	Storm drain inlets	replace	2nd to Embarcadero	14
Potable Water	1.	12" pipe	relocate	@ Townsend/Embarcadero	350
	2.	8" pipe	support in place	xing @ 2nd	50
Auxiliary Water	1.	5' ϕ concrete	lower	xing @ Townsend	100
Gas	1.	6" pipe	support in place	xing @ 2nd	50
	2.	4" pipe	support in place	xing @ Townsend	50
Electrical	1.	Streetlights/signals	replace	2nd to 1st	14
Communications					

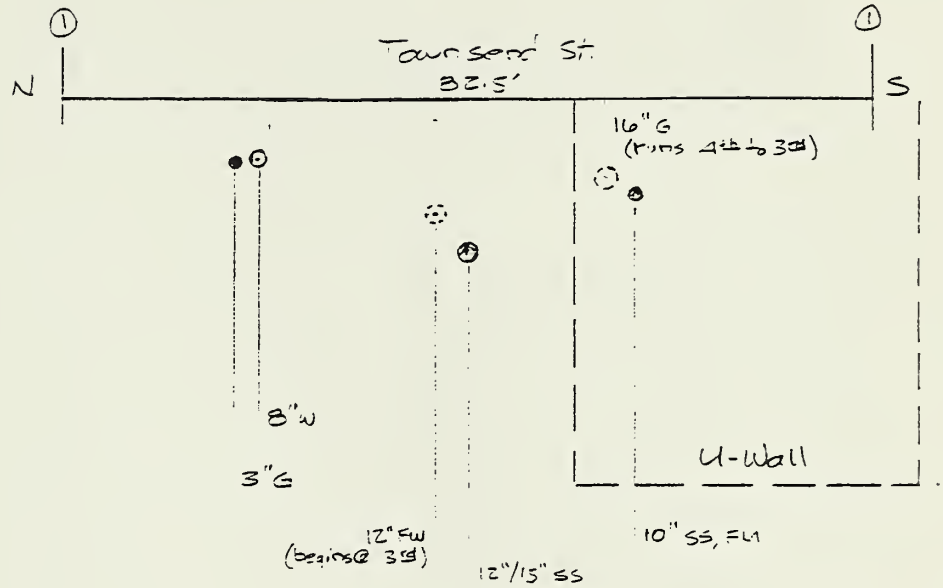
APPENDIX B

Street Utility Cross-sections

H: 1" = 20'
V: 1" = 10'

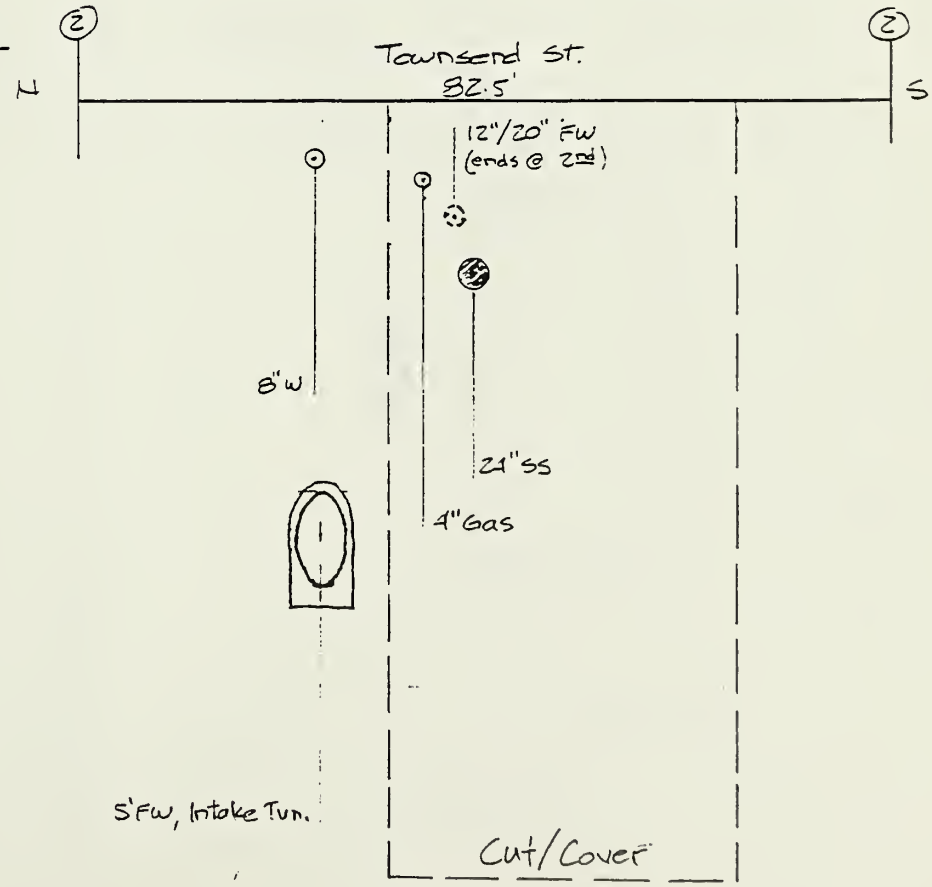
SECTION 1

Townsend @ 5th



SECTION 2

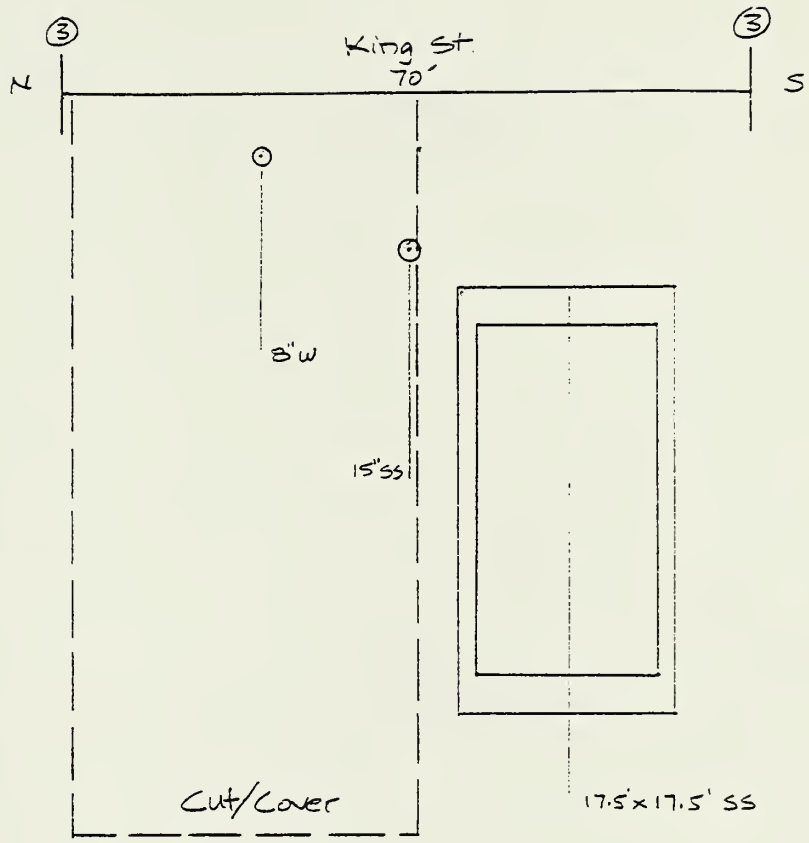
Townsend @
Colin P. Kelly



H: 1" = 20'
V: 1" = 10'

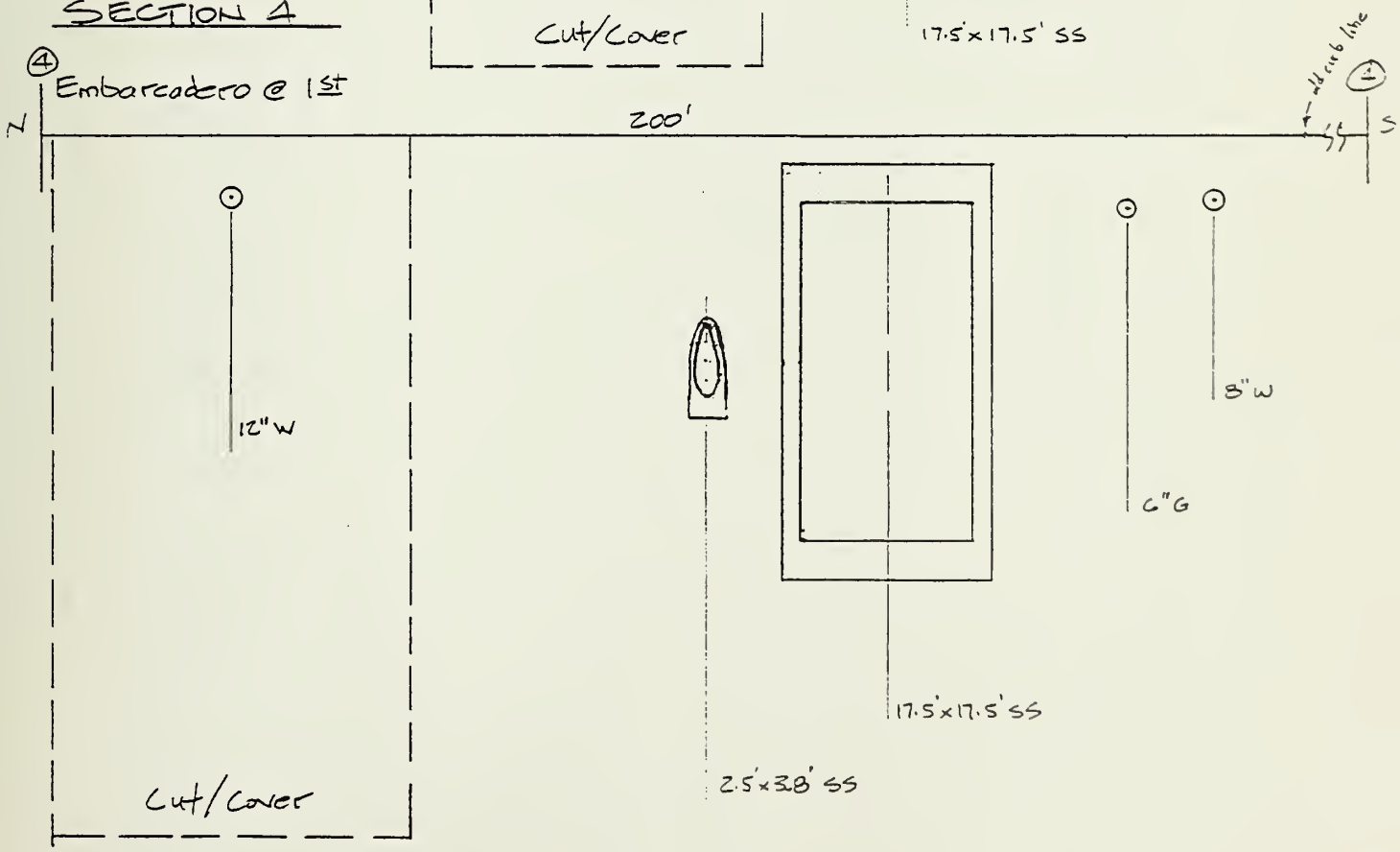
SECTION 3

King @ 3rd



SECTION 4

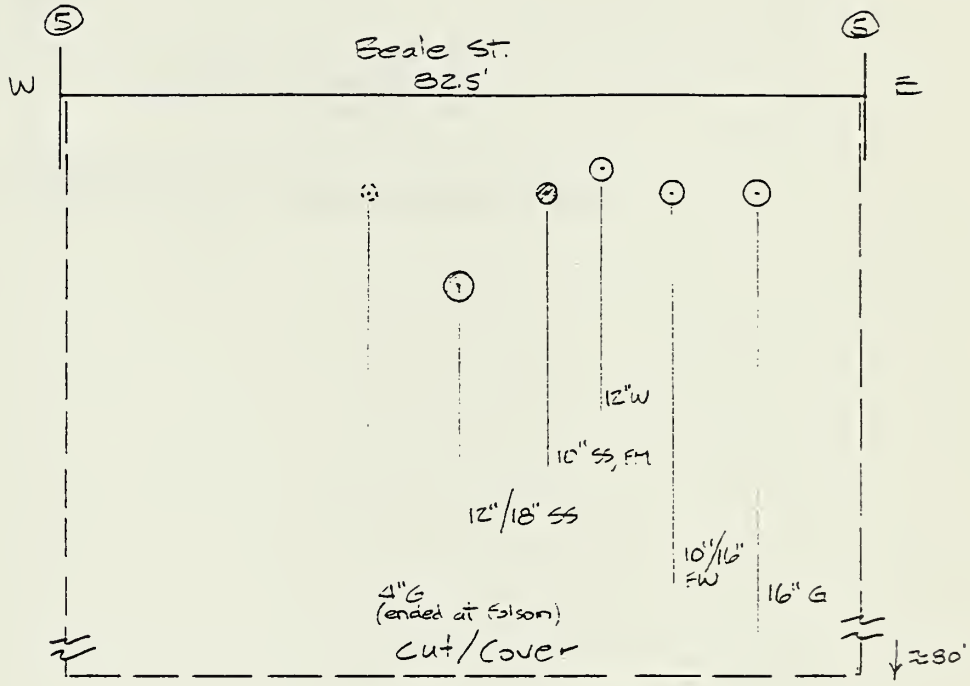
4 Embarcadero @ 1st



H: 1" = 20'
V: 1" = 10'

SECTION 5

Beale @ Folsom



APPENDIX C

Definition of Abbreviations Used

Definition of Abbreviations Used

AWSS	Auxiliary Water Supply System (Fire Department)
ISP	Iron Steel Pipe
VCP	Vitrified Clay Pipe
RC	Reinforced Concrete
RCP	Reinforced Concrete Pipe
CI	Cast Iron
PL	Plastic
DPW	Department of Public Works